MEDICAL EDUCATION & PROBLEM-BASED LEARNING:

COLLABORATION, CONTRADICTION & CONFLICT

by

Margaret Ann Bunting

Thesis submitted to the University of East Anglia for the degree

of

DOCTORATE IN EDUCATION

2016

This copy of the thesis has been supplied on condition that anyone who consults it is understood to recognise that its copyright rests with the author and that use of any information derived there from must be in accordance with current UK Copyright Law. In addition, any quotation or extract must include full attribution.

Abstract

Medical Education & Problem-Based Learning:

Collaboration, Contradiction & Conflict

This is a phenomenological study about problem-based learning (PBL) in medical education. Whilst there are strong arguments for PBL having a key presence in today's undergraduate medical curriculum, there is little empirical evidence to show whether or not students fully engage in the opportunities that advocates of PBL claim it offers. This study was approached from the viewpoint that it is important to establish the students' interpretation and acceptance of PBL, as they are, in practice, the key protagonists. Eleven in-depth, one-to-one, semi structured interviews with medical students offered the main focus for exploring PBL as a phenomenon, but additional sources of evidence were included; observation of PBL sessions, photographs of student study areas, copies of student note taking, and data on a student's weekly study activity.

The students' narratives from the interviews, and additional sources of data, enabled a detailed exploration of PBL. Further analysis of the data took place against the backdrop of literature on PBL. The data suggest that whilst students were identifying some of the opportunities that PBL affords, there were a number of constraints and conflicts which were affecting their learning and that, at times, this was leading to a sense of frustration. This study supported the view of PBL as a pragmatic solution for designers of undergraduate medical education because, within PBL's methodology, it promotes self-directed learning, which can be closely tailored to the programme objectives. However, if the adopted process of PBL leads to an emphasis on participation over that of construction of knowledge, medical students can be left feeling frustrated by PBLs seemingly inefficiency. The findings of this study suggest that PBL can address relevant learning objectives for preparing students to be doctors but its methodology is, at present, not successfully competing against the heavy presence of knowledge based assessments within a medical curriculum.

Contents

List of Tables

List of Appendices

Acknowledgements

I would like to thank the following people for their invaluable support and guidance throughout the writing of this thesis:

Professor Nigel Norris of the University of East Anglia;

Professor Victoria Carrington of the University of East Anglia;

Christina Mason, Pauline Bryant, Laura Bowater, Barbara Jennings, and Richard Holland of the Norwich Medical School;

Susan Tierney, my best friend, who sadly passed away without seeing the completion of this thesis.

My sister, Jo Bunting.

And of course to all the students who participated in this study. Thank you for your honesty, your insights and for giving up your time - a commodity that I appreciate is a very precious one in the life of a medical student.

Chapter 1

Introduction to PBL in practice and the questions being raised.

This study took place at the Norwich Medical School (NMS), within the University of East Anglia. The NMS's first intake of students was in 2002 and as a new school was set up as a problem-based learning (PBL) course. Students conceptions of what is PBL could determine how well they approach learning within this local setting. As a tutor in the medical school it is the learning potential and the learning that takes place that is central to my practice. With this focus in mind, my aim was to further my understanding of the learning potential of PBL, and in order to explore the phenomenon of PBL I chose to study students' experiences of PBL.

1.1 PBL within the context of medical curriculum

All medical courses are carefully planned to give students a wide range of academic and practical experience, leading to the award of Bachelor of Medicine and Surgery (MBBS) and preparing them to practice as doctors. Whilst each course is overseen by the General Medical Council, it is recognised that course structures vary, and Piumatti (2010) explains that the variation is centred on the main method of teaching chosen. In particular, variation exists around underpinning knowledge acquisition, whereas clinical teaching is similar in all courses. Clinical teaching is undertaken in both the hospital and the primary care placements and the teaching is in small groups facilitated by clinicians. Piumatti (2010) identifies three main course designs within medical education; traditional, problem-based learning and integrated. The traditional British medical course, Lowry (1992, p.1277) explains, has two years of the preclinical sciences of biochemistry, anatomy, and physiology followed by three years of the clinical course. Learning in the first two years is subject-based, delivered didactically in lectures by university staff who are qualified in the science they are teaching, rather than being medically qualified. This course design has become quite rare and is presently only attributed to Oxford, Cambridge and St Andrews. At the other end of the continuum is an approach called Problem

Based Learning (PBL). PBL is patient orientated, learning through clinical scenarios, and the framework is often structured around a bodily system, for instance the respiratory system. Learning outcomes are inclusive of all the relevant disciplines that have aspects germane to a doctor in treating a patient with that particular condition. At this end of the spectrum, patients' case studies and relevant clinical placements form a concurrent part of the building of knowledge. Piumatti (2010) explains that whilst there are a number of courses that are assigned to this style - the present location of this study named as being one of them - most courses fall between the two styles, which he terms 'integrated', and which he explains as the teaching of preclinical science and clinical studies, with patient contact increasing as the years progress.

In the location of this study, PBL is a compulsory three-hour weekly session that medical students attend during campus based teaching. PBL is introduced in the first year of the MBBS programme and continues for the duration of the five year programme.

1.2 My background, experience and interest in PBL

I am a qualified nurse and midwife, and during my seventeen years of midwifery practice within the NHS, I became increasingly involved in teaching. With a new medical school opening that was affiliated to my hospital, I took the opportunity to increase my teaching commitment and started to teach medical students. My main area of practice was with small group clinical skills teaching. I found the students' intelligence and commitment to learning, along with their respect for my contribution towards their understanding, very satisfying and enjoyable. Having gained several years experience, I made the commitment to transfer from being a full-time practitioner to a full-time lecturer. I joined the medical school in 2007, which happened to be the same year the student research participants commenced the course. For me, working within a higher educational institute, as well as in medical education, was a very new experience. It was during my application to be a

lecturer in medical education that I became aware of Problem Based Learning (PBL). The job specification emphasized that PBL was a key component of the curriculum and went on to specify that the post holder was required to be in agreement with the principles and the approach of the curriculum design. Accordingly, my introduction to the literature around the subject of PBL within medical education started before I secured a place as a tutor. On commencing my role as a lecturer, there was a strong sense of pride amongst the staff in having a problem based curriculum. The Dean at the time was very keen that the course be identified as a problem based learning curriculum rather than an integrated curriculum. This confidence and clear direction offered by senior staff gave me a sense of trust and support.

My induction training in problem based learning (PBL) consisted of a two-hour session where the ethos and process was explained. I was enthusiastic. PBL was offering me an opportunity to participate more widely in medical education, and 'tutor' beyond my own area of expertise in obstetrics.

This introduction was backed up by regular tutor development sessions which offered an opportunity for issues to be raised and discussed with experienced PBL tutors. During these debriefs, we were often guided, through critical reflection to explore where we could facilitate an improved process in order that it may result in behavioral change, such as student engagement. It was our role, especially for tutors of the first year PBL groups, to guide the students through the process of PBL.

I undertook the role of PBL tutor for two groups - a group of ten students in Year 2 and a group of ten students in Year 4. The PBL group remains the same for a year permitting relationships to build between students and between students and the tutor. Being with students in the classroom allowed me the opportunity to start to develop an understanding of a student community learning medicine. By the time I undertook the fieldwork for this study, I had been a PBL tutor for six PBL groups and had a social ease within this particular system.

I understood the responsibilities involved in being an educator, and my choice of research was influenced by my desire to assist learning and offer pragmatic advice and guidance. It was my personal experience as a PBL tutor that led me to consider that the reality of PBL was proving different from the claims made within literature. The challenges I faced, together with my observation of the students' learning, were not being fully addressed by undertaking further development in the process of PBL. I was becoming aware that there was an undercurrent of disengagement amongst some students and frequent encounters with a group wanting to take 'short cuts'.

When I am teaching within my own specialty and I have a student who is struggling with a concept, I will often gain an understanding of the student's perspective and then work with that knowledge in order to guide them and support their learning. However, as a PBL tutor I didn't feel adequately equipped to support learning within a PBL session. I was discovering that by following the PBL process 'to the letter', there was no guarantee that full student participation would occur. Frequently learning goals were not fully articulated, for students to not be explicit about how they learnt a topic, nor to elaborate on what they found difficult to learn. It was only on infrequent occasions that an open discussion that involved the majority of group members would occur.

Exploring and understanding the student perspective on PBL became of great interest to me. I felt that if I could better understand their perspective, I may start to understand how I could better facilitate PBL. It was also apparent to me that the interpretation of PBL had a complexity that deserved more focused attention and further research.

1.3 What is PBL?

There are challenges when if comes to defining PBL. Charlin et al (1998) suggest that within the literature, authors' definitions of PBL can be categorised into its character, its purpose or its process. When defining PBL by its *character,* the

authors identify that the problem directs collaborative learning that crosses discipline specific subjects. Authors whose definitions of PBL focus on its character include: Charlin et al (1998), Woods (1994), Norman (1989 cited in Maudsley 1999), Albanese and Mitchell (1993), and Vernon and Blake (1993). A definition that focuses on *purpose* (Charlin et al (1998), Norman and Schmidt (1992), Engel (1991), Barrows (1986), Maudsley (1999)) describes how the learners are required to be active processors of information, be it prior knowledge that is being activated or the building of new knowledge. By being active, development of skills such as elaboration, organization and self-directed learning are commonly associated with PBL. The purpose of PBL, within these definitions, extends to development of skills necessary for lifelong learning. It seems that Charlin et al's (1998) categories of character and purpose can also be seen as definitions that are incorporating a philosophy of learning rather than an instructional method. However, this has been addressed by some authors who have focused on the *process* of PBL as a way of defining it. This includes Boud and Feletti (1991), and Walton and Matthews (1989), who have identified facilitative conditions such as small group working on one problem at a time, and the problem being set in context. Schmidt (1983) offers more detail with a seven step process to define PBL. Charlin et al (1998) point out that the process can vary from one institution to another and would therefore seem to be a dimension that has the least to offer. However, it is often by defining the process of PBL that it is most readily allowed to stand apart from generic good learning principles. As Boud and Feletti (1991) note, without focus on the process, PBL is singularly undefinable because it incorporates multiple and diverse educational approaches.

However, the process of PBL isn't stable either. Taylor and Miflin (2008) say that PBL is a product of decades of adaptation and development, all of which have resulted in legitimate interpretations of PBL. Barrows (1984 cited in Maudsley 1999) demonstrates this point as he considers his own approach to PBL to be a different even from those who asserted that they had copied his! Indeed, after being 'copied' by a number of institutions, and in a variety of settings, the McMaster curriculum itself had a major revision in 1983 (Neufeld et al 1989). Vernon and Blake (1993)

and Taylor and Miflin (2008) throw light on the underlying reasons for these adaptations - each medical school adopting PBL will inevitably introduce changes as it transfers one version of PBL to a local institute that will require local variations (compromises) according to resources and the degree of acceptance. Vernon and Blake (1993) suggest that this will be further diffused by faculty members' interpretation of curricula, while Taylor and Miflin (2008) suggest students bring their own beliefs and values to the PBL process. Taylor and Miflin (2008) believe that different expressions of PBL remain legitimate, but highlight the issue that any attempt to find a definitive meaning for PBL is futile.

Whilst no single definition for PBL exists, there are identifiable features within PBL's approach to learning. Maudsley (1999) and Vernon and Blake (1993) identified that the common ground in defining PBL is that it involves problem-first learning via work in small groups, it is student-centred, tutor monitored and involves independent study. The overall intended objective is that PBL facilitates active, self-directed and deep learning (Baroffio et al 2012)

Arguably, the single distinguishing feature of PBL from that of case-based, Inquiry-based, or project-based learning is the problem. There is clear agreement within the literature that the problem is the starting point for PBL. Within a small group of students, trigger material is aimed at provoking a discussion. A written problem is the most common format. Olson (1987) refers to the problem as the 'paper patient', but, irrespective of how the trigger material is presented, the essence is that the students approach the problem cold - in other words, *before* students have learnt the relevant basic science and clinical components. Gijselaers (1995) describes an important aspect that problems should reflect, or are carefully designed to refer directly to, the problems of professional practice. Evensen et al (2001) explain that the disciplines relevant within medical education such as law, ethics, economics, and anatomy, as well as the expected health specialties, are integrated both within the problem but also within subsequent timetable activity.

1.4 The PBL process

Within the literature there are a number of models demonstrating the possible process of PBL. Examples include Lauridsen (2012), Yeo (2008), Stonyer and Marshall (2002), and Schmidt (1983). PBL is often described by breaking down its process into stages or phases, and the following offers an explanation of the common identifiable features of the PBL process.

Stage 1

The PBL group meet and are presented with a clinical problem that they read through. They discuss and analyse (brainstorm) the scenario including clarifying any new terminology and discussing prior knowledge or experience relevant to the scenario. Students will have various degrees of prior learning. Once this part of the discussion is exhausted, the group generate and prioritise learning objectives by identifying learning gaps. The tutor has the faculty objectives relating to this stage in the process and will guide and facilitate as required, so that the students focus on generating learning objectives that are aligned with that stage of the curriculum.

Stage 2

The individual members of the group direct their own learning around the groups' generated learning outcomes. They select their own resources and learn the knowledge that has been identified.

Stage 3

The group resumes after a period of time. The group presents its learning to synthesise a comprehensive explanation of the newly acquired information, or generates a group discussion to reapply the newly acquired information back to the original scenario. This 'feedback' session is considered to support a constructivism approach to learning, whereby students are offered an opportunity to explain to their peers their understanding, and which can then be verified or corrected by their peers.

Whilst the present study incorporates the elements above, detailing the process at a local level is beneficial.

1.5 The context of PBL at UEA

The MBBS curriculum within NMS is centred on PBL. PBL is framed within an integrated organ system-based curriculum. All of the anatomy, physiology, pathology, pharmacology, etc. about one organ system (e.g. the heart) is taught at one time, before going on to the next organ system. Each organ system (referred to as a module) is assigned a set number of weeks for campus-based learning, a set number of days in primary care and a set number of weeks in secondary care. During the campus-based weeks, there are learning outcomes for each weekly focus area. The focus of the week's learning is introduced and explored in the PBL session. The learning week goes on to include lectures, a primary care placement day, independent self-study time and, where appropriate, consultation skills and anatomy dissection. The module is concluded with an objective structured clinical examination (OSCE). By the end of the academic year the students will have completed three modules and then sit a written exam and an end of year OSCE that integrates all their learning to date.

The problem scenarios were originally written by the inaugural curriculum development team, directed by a Professor in Medical Education who had personal experience of PBL. The role of the original curriculum development team was to ensure that a learning outcome was identified for every aspect it wanted a medical student to learn. This prerequisite continues today, highlighted by the fact that every exam question has to have its affiliated learning outcome identified. Once the team had devised all the learning outcomes, it allocated them to a specific week. The original team then wrote the 'problem scenarios' to elicit these weekly learning outcomes. The result is that the whole curriculum is covered by a total of 112 clinical cases. The ongoing monitoring of these learning outcomes is currently in the domain of the Module Lead along with any modifications to the problem scenarios,

while PBL is overseen by a PBL steering committee, chaired by a nominated Academic Director for PBL. PBL tutors are encouraged to give feedback to module leads and/or the Academic Director for PBL. An example of a problem scenario given to students in year 4 can be found in Appendix 1. The learning outcomes affiliated with that scenario can be found in Appendix 2.

Learning through PBL is consequently considered essential within the NMS curriculum. Each PBL group has 10 students and one PBL tutor, and the PBL group remains as a group for the duration of an academic year. The PBL session is divided into two parts: the 'brainstorm' and the 'feedback'. By rotation, at each group session, student members fulfil the role of Chair, scribe or group member. Rotation ensures that students undertake, over a period of time, all of these roles. During the brainstorm, the Chair facilitates the group to analyse a problem scenario, and student-generated learning objectives derived from the case are written down by the scribe. The PBL tutor facilitates the students in identifying the relevant learning issues for that week. These student-generated learning issues are made available to the group members, so they can organise their self-directed learning and in addition, they allocate the learning objectives equally amongst themselves, so that each student has the task of researching a learning objective and producing a written summary for use by the whole group. The students are supported in their learning within the given week by relevant lectures, and by seeing patients within primary care which is facilitated by a GP tutor. At the next PBL session, the students take the opportunity to feedback to each other. This takes the form of mini teaching sessions or a group discussion around the original paper case. At the end of the given week, the faculty learning objectives are made available on BlackBoard. The input and guidance from the PBL tutor should ensure that these are similar to the student-generated objectives. The students then proceed to brainstorm the next problem.

Medical students are introduced to PBL during a session within their induction week and supported by a student and tutor PBL handbook. The academic director for PBL gives a lecture that introduces them to the idea of PBL as a discussion forum to

support learning. The students are informed that PBL involves collaborating in small groups, that it is facilitated learning rather than teaching, and that learning is by means of self-study through problems that are first discussed in the group. The handbook identifies positive aspects of PBL, such as supporting students to develop a proficiency in searching and critically evaluating medical literature, and to develop critical thinking abilities, clinical reasoning capabilities, teaching and presenting skills, and teamwork skills, as well as acquiring medical knowledge and understanding. The handbook correlates these attributes to those required for life as a doctor.

1.6 Conclusion

My experience of PBL did not accord with the popular descriptions of PBL found within the literature. The apparent diversity of practices led me to want to examine PBL using a research approach that would provide me with a better understanding of PBL within a particular setting. I work within a curriculum in which weekly PBL occurs during the campus-based teaching periods of each module throughout the five year MBBS programme at NMS. In its broadest sense, PBL refers to an educational method/philosophy in which students identify issues raised by a specific problem in order to develop an understanding of basic concepts and principles. At NMS, PBL is based on case scenarios generated from how patients present to doctors. Through discussion, students become aware of their existing knowledge and their knowledge gaps, which provide a foundation for the week's learning. As students progress through the week, new information and experiences through lectures, primary care experience and self-study can then be built around and incorporated into their existing understanding of a topic. Very few research studies have explored students' experiences and understanding of PBL and how they have incorporated the experience of PBL into learning medicine in preparation for graduating into the medical profession. As a result, questions about how best to integrate students and facilitate the learning potential of PBL, remain unanswered. It is this gap in the literature that I have wanted to address in this research.

Chapter 2

Background and Context

2.1 Introduction

This chapter contextualises my research by providing background information on the literature relating to PBL. My position at the start of my research was that I was aware of being in an environment of uncritical acceptance of PBL. With a view to reaching a personal stance on PBL, the literature was searched with three objectives in mind. This literature review begins by analysing PBL's present place within undergraduate medical education in Britain. This is followed by an exploration of the relationship between the learning theory termed constructivism and its affiliation as the theoretical underpinning of PBL. Finally, there is a synopsis of the research that has aimed to empirically establish the effects that PBL has on learning since its implementation, and students' perceptions of PBL. The review identified a gap in qualitative analysis of students' views and perceptions regarding PBL, and this chapter considers the timeliness of this study when students' response to PBL remains speculative, despite the students' voice having been a major drive for the most recent curriculum reform

2.2 The literature search

In order to facilitate my understanding of the phenomenon of PBL, a literature search was conducted. The university's database, LibrarySearch, which is linked to Medline, the Educational Resources Information Centre (ERIC) and the British Educational Index, and expanded beyond the university's library collection, was screened for English-language abstracts, books and theses. The search term 'problem-based learning' alone elicited 29,504 results. Initial filtering of this search term by using this term only if identified as a subject, rather than within the text, led to 18,495 results. Combining this *subject* search term with *subject* terms of "medical education" AND 'undergraduate' AND 'student*' reduced the results to

1,378 items. In order to filter further, the term “problem based learning” was set to only identify the term within an *abstract*. This reduced the result to 275. When the term “problem based learning” was searched only in *title* with the other terms as *subject* the results reduced to 233. Whereas using this term in the *abstract* rather than the *title* is likely to lead to a more contextually accurate retrieval, it was reassuring that *title* didn’t filter out as many publications on PBL as assumed, so, titles which clearly described the article as being on PBL became the focus. I felt that this final search process would elicit articles most relevant for my background research and to a manageable degree. This search was saved and remained ongoing. The articles from the search result were further filtered manually through my examination of the title and abstract, using my expertise to decide what was going to be most relevant to my research. I was mindful that this didn’t introduce too much bias. In order to ensure a neutral filter, my inclusion criteria was identified as literature pertaining to the curriculum reform in medicine, research regarding the effects of PBL on learning and students’ views and perceptions regarding PBL. This reduced the retrieval to 171 articles. These articles were examined for their citations which led to a purposeful search. I also included internet resources such as ‘Google’ in my literature search. Further relevant educational literature were purposely searched for as emerging findings seemed to demand it. Such literature has been integrated into the later chapters.

Exploring the literature on the history of PBL within medical education produced a number of relevant books and articles published in the 1990s. Literature published more recently proved not to add anything new to the emerging synthesis. Therefore, the literature cited within this thesis has been chosen if the opinion, comments or findings seemed original to the author, and subsequently literature dating back 25 years has been frequently used.

The initial review of the titles and abstracts from this search noted that literature on the student’s perspective was sparse (19 articles). Research around a student’s perspective was often centred on a learning task within PBL such as their perception of the tutor’s role, or their perspectives on effective small group discussion.

Therefore, in order to maximise access to relevant literature in this area, a supplementary search strategy within the EThOS database proved necessary. Nonetheless, there still remained only three studies involving the medical student's voice on aspects within PBL. During the course of my studying, more literature on student perspectives is being published. Of the 19 articles retrieved in the initial search, only 5 of these have been published in the past decade. Only three studies are UK based medical students and the latest of which was 10 years ago. From these articles focusing on the students' perspectives 4 studies included interviews for data collection. The most frequent data collection method was the use of Likert type questionnaires or surveys. Students conceptions and perspectives on PBL can play an important role in exploring the reality of everyday PBL in practice, and yet to date interesting and informative information elicited from these studies have rarely been able to offer an in-depth exploration due to the chosen methodology.

2.3 The driving force behind the introduction of PBL - A brief history of undergraduate medical education

Sinclair (1997) reported that the publication of the first Medical Act in 1858 marked the beginning of the modern development of medical education in Britain. The link between this Act and the education of doctors is that it legislated for society to delegate some of its powers to the medical profession. Cruess and Cruess (2005) believe that the right to self-regulate was one of the most important aspects. They explain that the role of self-regulation is to provide assurance that those in practice maintain their competence, and that doctors take appropriate action once a problem with an individual practitioner has been identified. In the context of medical education, Cruess and Cruess (2005) say that whilst there are a number of layers to this regulatory system, they all aim to offer the public reassurance that their protection remains the central focus of medical training, and guarantee the competence of practising doctors.

It is important to note that whilst the General Medical Council (GMC) acts as the overall regulator, it is at a local level where decisions regarding curriculum design, content, and assessment are made. Medical schools must only graduate students into the medical profession who they deem to be competent practitioners. In a modern democracy, the self-regulatory responsibility of the medical profession is a privileged position. Cruess and Cruess (2005) critique this model by suggesting that it can be viewed as a privilege that serves the interest of doctors, rather than that of the client, and report that the GMC is aware of this. As a result, in recent years the GMC has focused on promoting individual doctors' good character, conduct and competence in order to maintain public trust in the system. The managing and regulating of medical education has a significance when considering the driving force behind the introduction of PBL and will be explored in more detail.

Since 1892, the qualification for Bachelor of Medicine and Surgery (MBBS) has been a five year training programme. The Medical Act of 1950 introduced an additional compulsory pre-registration year (known today as a foundation year). Therefore, on completion of the undergraduate course, a doctor obtains an MB BS and has a provisional registration with the GMC, but cannot practice independently until completion of a further year's apprenticeship. Sinclair (1997) said that this compulsory pre-registration year addressed the concern that the five year undergraduate curriculum was no longer capable of producing doctors competent in all branches. Sinclair (1997) believes that present day medical training is a highly sought after course that offers academic cachet. He explains that while the main determinant of entry into medical school is academic achievement, this has only been the case since the early 1970s, when a sudden increase in high A-level grades among applicants was coupled with a limited number of places to study medicine. Whilst academic cachet may be relatively new, the medical profession has historically been associated with high status and high earning potential rivalled only by those practising in law.

A common thread within the literature on medical education in the 1990s was the need for curriculum reform. Sinclair's (1997) qualitative study of medical students

during 1993/4 noted that, whilst there had been a sense of stability in the traditional way of teaching medicine within the UK for some time, questions were beginning to be raised about whether the content being taught had any direct benefit for the patients. A key concept here was that the curriculum content was not addressing the evolution of specialities within the profession, and that this diversity was not only confined to doctors working in hospital but also the development of community based medicine. Indeed such conflict was documented as early as the 1950s. Newman (1957) suggested that the lack of reform was because the main difficulty in medical education was not what to teach, or how to teach it, but to make up one's mind exactly what one was trying to produce. Lowry's (1992) review of medical education in Britain strongly supported immediate reform within UK medical education. Lowry's (1992) review, in essence, found that the medical curriculum was no longer fit for purpose. Lowry (1992) supported the claim that part of the reason for this 'crisis in medical education' (p1277) was that the role of the doctor was changing to include specialist training, working in multidisciplinary teams, and the delivery of health care moving away from a dominance of hospital based environment to being community based.

Lowry (1992) identified that doctors themselves were also changing their attitude. Lowry (1992) believed that an external but influential factor around this period was an increased awareness of dissatisfaction and disillusionment among medical students and their choice of career. This had been captured in a successful BBC series broadcast in 1992, ‘Doctors to Be’, which followed medical students through their course at London's St Mary’s Hospital Medical School. This disillusionment was reflected throughout the country by the falling application rates to all medical schools. Lowry (1992) reported on data from the Universities’ Central Council on Admissions that confirmed fewer people were applying to study medicine despite large increases in applications for tertiary education as a whole. Change brought about through the 2000 Improving Working Lives Standard (DoH 2000) improved the work life balance within the medical profession by reducing the long hours. In reference to medical education, this change led to doctors taking more time to become 'expert' and therefore affected the delivery and content of their education.

An additional pressure was that the public were increasingly well informed and, with many not remembering life before the NHS, the medical profession was having to be more accountable for the way in which it spent taxpayers' money. The change in the public's expectations of doctors is illustrated by Firth-Cozens' (1989) comment regarding selection of applicants to the profession - that well rounded individuals excelling in the much needed skills of empathy and communication were not being selected over high academic achievers - raised the issue that survival of the fittest may no longer be survival of the best.

The Impact of these changes within the profession led to medical schools responding immediately, but only by adding new disciplines to the course and new knowledge within the old disciplines. Lowry (1992) reported how this led to increasing identification of an overwhelming burden of facts that medical students had to learn, particularly in the preclinical years, and gave further momentum for medical schools to seriously consider a change in the traditional method of teaching. Previous attention had been paid to the curriculum, Cavenagh et al (2011) reported that the GMC had expressed concerns regarding the curriculum as early as 1963, stating it was overloaded and did not allow the student time for self-education. This concern was repeated in subsequent GMC publications, for instance a paper produced in 1980 called for a reduction in the factual overload in the curriculum and the promotion of self-education and critical thought (GMC 1980). However, it wasn't until after the GMC publication of Tomorrow's Doctors (GMC 1993), that the present day medical curriculum started to evolve. 'Tomorrow's Doctors', published in 1993, produced a series of recommendations for basic medical education including the need to define a 'core curriculum' in order to reduce the factual overload. Towle's (1991) national inquiry into medical education confirmed that there was increasing widespread agreement that the curricula were grossly overcrowded. Towle (1991) suggested that as medical facts expand so quickly, and also just as quickly go out of date, attention was needed to the development of the skills to identify gaps in knowledge and go about finding solutions to the problems. Lowry (1992) agrees that doctors needed to develop strategies such as critical thinking and problem solving in order to keep themselves

up-to-date with the changes that would inevitably occur during their professional lives.

Lowry's (1992) series of influential articles looking at medical education were published, not in educational journals, but within the British Medical Journal, and Cavenagh et al (2011) suggested that this prompted a wide influential audience of decision makers within the medical profession to act. Lowry supported the GMC's suggestion that in order to meet the recommendations within 'Tomorrow Doctors' (GMC 1993), solutions should involve the introduction of a 'substantial component of problem based learning'. At this time, PBL had been successfully introduced into medical education in McMaster University, and was subsequently successfully adopted by other medical schools outside the UK. This strong lead from the GMC, and the persuasive manner of the supporting literature, gave medical schools the impetus to start reforming medical education and consequently also became the driving force behind the introduction of PBL into UK medical schools.

2.4 The introduction of PBL within medical education

By reviewing archived medical schools' curricula it is possible to map the dissemination of PBL within the UK. 'Learning Medicine' and similar books such as 'The insiders' Guide to Medical Schools' are published yearly and are written for prospective medical students. 'Learning Medicine' commenced its first edition in 1983 (McManus 2011) and a new edition was brought out nearly every year. Similarly "The Insiders' Guide to Medical Schools' also gave an insight into individual medical courses and commenced in 1998. By obtaining back copies of these two guides, the introduction of PBL and other changes within medical education can be mapped. In 1983, the medical courses of the then 23 UK medical schools were separated into preclinical and clinical years. The preclinical years were lecture based, building up knowledge with particular emphasis on basic science, and the clinical years were largely apprenticeship. The updated versions demonstrated that the medical schools were beginning to integrate the preclinical with the clinical, and

by 1993 Richards (1993) reported that most medical schools were ‘in the process’ (p 30) of this integration.

Within the 1993 edition there is no mention of the term ‘problem based learning’ although components of what is considered PBL are mentioned, such as ‘centering teaching around clinical problems’, ‘the factual load being reduced’ ‘much greater emphasis to self-directed learning and decision making’. By 1998 (Urmston 1998) the pre-clinical/ clinical divide has almost disappeared, except for a few universities such as Cambridge. In 1996 Liverpool introduced a PBL curriculum, with the explanation that it was a "new curriculum after many years of planning. Subjects are no longer taught in lectures day in, day out, and different areas of medicine are presented to students as problems". It concluded by stating that one of the best things about Liverpool medical school was that the new course "is developing a different approach to studying medicine and training doctors for the twenty-first century". The course was described thus: "the new course is not for people who want to be spoon-fed, in the traditional formal lecture style" (p51 Urmston 1998). PBL is mentioned in other universities within this 1998 edition such as Aberdeen, Dundee, Glasgow and Edinburgh stating that they were just about to introduce it. However, they are phrased less powerfully and imply there is a PBL approach within the teaching, but not fully integrated within the curriculum.

In the 2002 edition, a section within The Insiders' Guide to Medical Schools (Almoudaris et al 2003) contained a short paragraph on traditional teaching methods versus problem-based learning, with the explanation of PBL being that it ‘relies to a significant extent on group work and individual study. This means fewer timetable commitments, but you will have to sustain a lot of self-motivation’ (p25 Almoudaris et al 2003). The 2004 edition (Ciechan et al 2004) outlines two ‘broad teaching methods’ within a medical school, the traditional and the PBL method. There is a more detailed explanation of PBL and the fact that some medical schools may combine both methods of teaching. This explanation is repeated, but with no further elaboration, in the 2007 (Girgis et al 2007) edition.

Since 1998, the number of medical schools within the UK has increased, and for the 2012-2013 intake there are a total of 29 medical schools (See Appendix 3; Teaching method profile). Very few medical schools claim to have a PBL curriculum. Those that do are the new medical schools of Brighton, University of East Anglia (UEA), York, Manchester, Peninsula, Barts' in London along with Liverpool, and Glasgow who make the clear statement "with Problem-based learning at the core" (p118 Ciechan et al 2004). Glasgow was not the only one highlighting PBL specifically, Hull York Medical School (HYMS) also used PBL as a promotional tool. 'We want medical education to be exciting and effective: modern methods of PBL, computer-aided learning, and a fully integrated curriculum will put HYMS at the cutting edge of medical education' (p86 Almoudaris et al 2003). Most medical schools explain that they have a hybrid of teaching methods that include PBL. Indeed, the more recent profiles seem to tone down the PBL aspect. For example the profile for Imperial College London which was to take new students for the first time in 1998 stated that "Problem-based learning in small groups will be a key feature of the teaching' (Urmston 1998 p109). However, by 2007 "Didactic teaching is the mainstay of teaching at Imperial, with problem-based learning small group sessions also in place to reinforce learning' (p93 Girgis et al 2007). Following a curriculum evaluation, Glasgow, after a 10 year PBL course, introduced a week of lectures in year 2 and 3 to 'give students a better scientific grounding before they embark on the PBL sessions" (p134 Ciechan et al 2004). Not all medical schools followed the trend to introduce PBL in the first place and opted to state their allegiance to the 'traditional' curriculum "Taking a traditional knowledge-based rather than problem-based approach" (p280 Girgis et al 2007). Nonetheless, by tracking the profiles in the "Insiders' Guide to Medical Schools' which was published annually between 1998 - 2007 the percentage of medical schools mentioning PBL as a method used within the curriculum had increased from 35% in 1998 to 55% in 2007. Looking on the university websites, this figure has increased to 76% by 2012 (Appendix 3; Teaching method profile).

With PBL taking on an increasingly significant role within the UK's medical curriculum, particularly at the new medical schools, it is clear that PBL is seen as a (if not *the*) solution to the problems and criticism facing traditional medical training.

2.5 Why PBL offered a solution

Providing a positive learning environment.

PBL originated at McMaster University, Ontario in the late 1960s and Norman (2008) explained that their initial goal was to offer medical training that was enjoyable to study. Norman (2008) wrote that the founders, gathered by the McMaster School of Medicine's first Dean to develop a curriculum, shared a negative view of undergraduate medical training and so developed PBL in order to improve the delivery and learning of medicine.

In a classroom at a Higher Educational institution, there is commonly a homogeneity in the students' previous educational achievements, leading to courses being tailored for undergraduate or postgraduate study. Medical education is unusual in that, within any one class, there is a mix of students, including both school leavers and students who have already successfully studied at university degree level. Taylor and Hamdy (2013) identify that the medical educators have to take this into account and provide an environment, and the resources, to accommodate the diversity of learners and enable all of them to flourish. Bate et al (2014) propose that PBL is considered as a method that helps to meet this challenge as the scenario facilitates the group members to activate prior knowledge, and for new knowledge to be linked with existing knowledge, whilst identifying knowledge gaps that need to be addressed through self-directed learning. In theory the heterogeneity of the group should enhance such a discussion.

Lowry (1992) reported on a GMC education committee document that PBL offers a means of addressing the dissatisfaction and disillusionment of medical students by bringing a different design to the curriculum. An area of greatest agreement in

literature reviews on PBL is that it is a more humane and enjoyable route and that medical students prefer PBL to traditional teaching (Sanson-Fisher and Lynagh 2005; Albanese and Mitchell 1993; Berkson 1993; Vernon and Blake et 1993). However, it is interesting to note that Newman (2003) only found that a study by Moore et al's (1994) met his criteria for inclusion in his systematic review although Moore et al's (1994) findings did favour PBL. Sanson-Fisher and Lynagh (2005) refer to PBL offering individual students a voice, something which they value, and they compare this to students in traditional teaching who are silent receptors of knowledge imparted by their superiors. Bigsby et al (2010) and Berkson's (1993) studies found PBL to be stressful for some students and faculty, possibly because of this increased participation requirement. Nonetheless, the key concept that Sanson-Fisher and Lynagh (2005) put forward is that the scenarios, within PBL, offer a patient-centred, integrated and 'holistic' manner in which to learn medicine, which, they say, sounds appealing both educationally and in terms of the values that it emulates. Sanson-Fisher and Lynagh (2005 p259) suggest that PBL is perceived to be offering something positive to the health care system.

PBL is readily associated with learning in small groups. O'Donnell (2006) details a number of benefits of small group learning, saying that they include socio-behavioural motivation, social cohesion, positive social-cultural values, skills in communication, collaboration, interpersonal skills, and an environment that can build social networks and develop professionalism. Bate et al (2014) agreed that small group learning was not only considered conducive to learning, but conducive to professional practice as well.

A means of addressing an overcrowded curriculum

Hmelo-Silver (2004) consider PBL as a solution to addressing the overwhelming knowledge base. The framework within PBL regards PBL as a facilitated starting point for self-directed learning that involves taking responsibility for addressing any gaps in learning and becoming familiar with seeking knowledge through various resources. While there is a PBL tutor, their role is not to be the main contributor of knowledge (Bate et al 2014; Ginty 2007; Hmelo-Silver 2004). An overarching aim in

offering practice in self-directed learning is to develop the student skills required for lifelong learning on graduation. This is, in part, because self-directed learning requires a self-assessment of learning needs which can be transferred to a more general lifelong learning setting.

Another important component is that PBL offers a pathway that integrates basic science concepts, with other subjects allied to medical practice, within a clinically relevant format. In doing this, PBL has encouraged teaching input from allied professionals. This offering of a different perspective has been cited by Norman (2008) as the possible reason for Koh et al's (2008) systematic review findings that PBL students have an improved awareness of cultural, legal and ethical aspects of care.

The original PBL, designed for the preclinical years, provided a means to support the removal of the traditional divide between preclinical and clinical education. Utting et al (2000) believe that PBL's success at addressing the overwhelming curriculum has been successful, and go on to say that PBL has also demonstrated an ability to offer a means whereby curriculum content can be changed quickly. Jones et al (1996) agree and say that PBL's flexibility within a curriculum has offered a solution to the increase in emphasis on topics such as community medicine and other learning areas that had been previously marginalised or neglected in the curriculum.

Achievable implementation and change.

Sanson-Fisher and Lynagh (2005) reported that since its introduction in the late 1960s, PBL has disseminated rapidly and successfully. Norman (2008) agrees, claiming that several hundred schools internationally are now offering some form of PBL. The way PBL is described within the literature makes it appear easy to understand and initiate, although straightforward global descriptions leave PBL vulnerable to a wide variety of interpretations. Welsby (1999) commented on the attractiveness of PBL as a method that can be trialed before any decision for complete adoption is considered. Not only that, as Sanson-Fisher and Lynagh (2005) note, the results of any trialed PBL session can be observed relatively quickly.

Sanson-Fisher and Lynagh (2005) highlight that PBL is an eminently observable process thereby allowing those faculty members to be introduced to the approach who are likely to observe small groups of engaged individuals, each contributing to the development of a relevant clinical problem. Sanson-Fisher and Lynagh (2005) believe that while the approach is good at selling itself, it was also introduced by often strong charismatic educators who have championed its use. Many newly founded medical schools are dedicated to the method, although obviously they didn't have the bastion of traditional methods to overthrow.

So PBL lent itself to being disseminated without too much opposition because its core message was a simple one. PBL offered an active learning environment for medical students where a patient-centred approach ensured learning of topics that were relevant. This ensured a motivational driving force behind students' independent study. The collaborative learning environment of PBL also offered a means to develop professional behavior alongside content knowledge.

2.6 The theoretical framework influencing PBL

Educational principles associated with PBL were theorised after PBL was conceived (Schmidt et al 2009), however it is generally agreed that the roots of the instructional approach of PBL are influenced by the principles within the learning theory of constructivism (Loyens et al 2007; Schmidt et al 2009; Kemp 2011; Kantar 2014). This section explores the theoretical framework that underpins PBL and critiques how the assumptions within a learning theory have been applied to the teaching approach underpinning PBL. This review aims to gain an insight into the origins of the practice of PBL in order to better understand the tenets of PBL and assist in reflection and analysis of my research data.

There are many notions which have arisen from research and lie within the broad term 'constructivism' but it is generally acknowledged that constructivism follows the view that knowledge is constructed by individuals, within social communities,

and that bodies of knowledge within a specific discipline are also human constructs (Phillips 1995). For example, in medicine, it is the active role humans play within this scientific community that advances medical knowledge and evidence based medicine.

Phillips' (1995) discussion on the range of constructivism identifies some of the complexities surrounding this theory as it evolved over time. The varied representations emerge as a response to two major issues; the first is the rejection of the belief that knowledge is 'discovered' or acquired through passive absorption. Constructivists who focus on this issue take different positions on the commitment spectrum relating to the extent to which knowledge is created by humans as opposed to knowledge being external. The second issue arises with the constructivists' position on the focus of knowledge being an individual construct or a focus on the general construction of knowledge. Phillips (1995) identifies Jean Piaget and Vygotsky as foundation figures of constructivism with both being concerned with how the individual learner goes about construction of knowledge. However, they place different emphasis on the purpose of education, Jean Piaget stresses that it is for individual cognitive development, while Vygotsky's emphasis is on social transformation. This theoretical argument has been addressed by some constructivists taking a hybrid position, where meaning is created by the individual but developed within groups, with social interaction playing a key role in the process of learning. It is this position that is commonly aligned to PBL (Kemp 2011).

This division of constructivism being aligned to PBL can be seen with Loyens et al (2007) identification of the broad assumptions of constructivism for learning as being:

- The learner is involved in knowledge construction
- prior knowledge guides learning through a need to relate new information to existing knowledge, a process known as elaboration
- cooperative learning through social interactions with fellow students, teachers and others contributes and enhances the construction of knowledge

- self-regulation prompts the learner to engage in self-directed learning and in doing so they develop a sense of responsibility for knowledge acquisition, autonomy and empowerment
- learning situations are preferable if they resemble real-life or authentic situations.

Phillips (1995) explains that constructivism, whilst a theory regarding learning, became a springboard to the education movement. The constructivist theory on learning to a method of teaching should not be viewed as offering how a student learns but how a student constructs knowledge. So, despite it not offering principles for teaching, it is often represented as such. To apply constructivism to teaching is to reject the belief that knowledge can be simply passed on from teacher to learner (Kemp 2011). The core principle rests on the belief that learning is a dynamic process performed by the learner and facilitated by the tutor. For instance, Phillips (1995) describes Dewey (1938) as staunchly advocating the use of activity methods in the classroom, so that students, rather than being passive receptacles waiting to have information instilled into them, should engage in activities such as discussion, working with others on a project, or researching a topic in the library. Loyens et al (2007) explain that elaboration can be accomplished by discussion, asking critical questions, answering questions, creating analogies and giving explanation.

The act of juxtaposing constructivism with transmission of teaching and learning, is not without its critics. Kirschner et al (2006) critique the premis of constructivism that students, in order to be taught how to construct knowledge, need to be presented with minimal information, and with minimal common instructional format. One of the main obstacles, Kirschner et al (2006) point out, is that partial information is less effective and less efficient, whereas complete information results in a more accurate representation that is more easily acquired. Kirschner et al (2006) believe that constructivism as an educational theory, and as an underpinning theory for PBL, is significantly flawed. They argue that if learners can 'discover' knowledge, without instructional guidance from content knowledge experts, then that implies that the experts' knowledge is irrelevant. The key point that Kirschner

et al (2006) are making is that whilst medical students can learn through self-directed learning, it is an inefficient method, and that for efficient learning of medicine they should be taught by subject experts, who also have pedagogical expertise. Kirschner et al's argument lies heavily on the role of a tutor transmitting content knowledge. Miflin (2004) also asks if PBL is making appropriate use of tutors' expertise or is in fact just promoting a do-it-yourself medical course. Schmidt et al (2009) believes that whilst transmission is absent in PBL, all other learning activities that are commonly associated with a tutor's repertoire remain present. They identify these as providing explanations, elaborating on knowledge acquired, directing students toward what is important to learn, engaging in purposeful conversations, encouraging students and providing feedback. Confrey's (1990) emphasis on the teacher being aware of students' constructs in order to modify them where necessary, does assume some knowledge expertise from a PBL tutor in order to engage in purposeful dialogue and to modify misconceptions. It seems that part of the purpose in having students engage in dialogue is to facilitate remediation through confrontation with new, more accurate conceptions (Schmidt et al 2009) but this role is being left to students' peers. Schmidt et al (2009) regard the tutor's role as that of supervising and guiding through conversation and cross-examination. This again, however, requires expertise.

The adaption of a theory on learning into a method of teaching has sometimes led to a belief that constructivism offers evidence on how an individual learns. In fact constructivism focusses on how an individual constructs knowledge. It is this misrepresentation that is leading to the criticism. Kemp (2011) provides a useful perspective in suggesting that constructivism is more properly used to underpin whether a particular situation has good learning potential rather than as a label for a method of teaching. She identifies what she terms as 'imperatives' to a learning situation as student centred, purposeful group dialogue, the opportunity for a learner to change understanding and for a learner to be able to develop effective self-regulation. Loyens et al (2007) would add that the authentic learning situation is also important and can be accomplished by confronting students with ill-

structured problems similar to the kinds of problems they will face in their future profession.

The principles of PBL connect with the imperatives identified by Kemp (2011). Schmidt et al (2009) suggest that a broad view of PBL is that it isn't a single educational method but a conglomerate of interventions, each of which is thought to foster learning. Within PBL there are different processes, and these each offer separate distinct learning opportunities for the student. Without an understanding of the underpinning theory of PBL, misunderstandings will occur. Dixon (2000) is concerned that educational changes, as promised by PBL, may be just window dressing without realignment of the philosophy of the educational reform. Dixon (2000) identifies the possible misinterpretation by suggesting that the concept of *covering* the curriculum as a goal should be replaced with the goal of *understanding* the curriculum. The term 'covering' is bound up with the concept of transmission of knowledge.

The tutor's commitment to the worldview on knowledge therefore is important. To have a reductionist point of view would be to turn PBL from a constructivist stance into a session for teaching, or a situation in which the students teach each other, whereas the constructivist paradigm would suggest that it is necessary to learn how to create situations that enhance student learning. Dixon (2000) explains that for a more constructivist point of view, the patients' social context should be a central concern rather than a peripheral concern, that conventional medicine is one view rather than the only view, and that the doctor is part of the equation rather than just a detached observer. The value is placed on understanding rather than gaining information and the PBL tutor is part of this equation but not all of the equation.

But what of the students' worldview on knowledge? Their learning prior to entering into higher education is likely to provide a very important role model as to how they perceive learning. Loyens et al (2007) studied students' conceptions of learning and identified that first-year university students were distinguishing constructivism concepts as important for their learning. Constructivism requires a great deal of

responsibility on the part of the learner and this can illicit different values and emotions in the students. Loyens et al (2007) found that this may lead to confusion and anxiety, coupled with feelings of doubt concerning one's own learning capacities, whilst others may experience the responsibility as a positive challenge and as part of the learning process. Hostility to PBL may arise if the students' conception of how knowledge is acquired is a reductionist view. Hendry et al (2006) undertook a questionnaire study looking at medical students' conception of PBL and found that most students do not think PBL is about learning independently but do identify it with working collaboratively to develop understanding. The different theoretical assumptions within a hybrid position on constructivism imply differing approaches to the learning tasks within PBL. It may not be surprising that this can lead to inconsistencies in what a student perceives the goals of PBL to be. It also follows that an under representation of the full learning potential of PBL may result.

Exploring constructivism has highlighted the importance of clarifying the implicit purpose behind the explicit learning tasks of PBL. PBL can only draw upon the principles of constructivism if the tutors and students know how to respond to the learning tasks within PBL according to the principle of the theory of constructivism. My own literature review agreed with Kemp (2011) that the conceptual links between PBL and a learning theory are rarely discussed within the literature. Similarly, educational theoretical underpinnings were not part of either the student's, or my, induction into PBL. My experience of PBL and the challenges I was finding led me to consider if I was pursuing PBL as a way to cover the curriculum, which is inherently bound up with a perception of transmitting information, rather than with the goal of student understanding. However, the divergent themes within constructivism will have implications for practice. Whether the view is on individual student understanding, social constructivism or a hybrid approach, the purpose and goals within PBL can shift. In particular, the different approach a PBL tutor addresses to their role may be influenced by whether they perceive themselves as expert or not. The educational focus that an expert tutor adopts may lean more towards the consideration of an individual's existing conceptual understanding, whereas a non-expert may be more inclined to connect with social constructivism.

Reviewing the literature on the educational underpinnings of PBL has provided an important reference to analyse and reflect on how both the students and I approach the learning potential of PBL.

2.7 The empirical evidence behind PBLs approach to learning medicine

An exploration of the empirical evidence on PBL within medical education found that, despite a wealth of research into PBL, its effectiveness at achieving what it claims to achieve remains unsubstantiated. Norman (2008) holds the view that dissemination of educational innovations is rarely down to good evidence-based reasons, and referred specifically to PBL's increasing adoption by medical schools as a case in point. However, there is little of an evidence base for traditional methods either, which have earned their legitimacy by establishing themselves over time. Gijselaers (1995) argues that any innovation is always on the back foot, with the innovators having to show that what they are doing is valuable. There is certainly a lot of literature published on PBL, which can be grouped into a number of broad types. This section focuses on research exploring the efficacy of PBL as a whole, and also the efficacy of specific key features of PBL such as group work. The difficulty is not in finding support for PBL but in assessing whether the empirical evidence of this support is able to stand up to close scrutiny.

Initial research triggered by the reassessment of medical education aimed to ascertain whether PBL effectively replaces the traditional method of teaching. This led to several meta-analyses (Albanese and Mitchell 1993; Dochy et al 2003; Vernon and Blake 1993) but there lacked an overall consensus. Albanese & Mitchell's (1993) meta-analyses found that the assimilation of basic science knowledge was weaker with PBL but did find a favourable trend regarding clinical science. Vernon and Blake (1993) found PBL enjoyed a significantly superior level of student satisfaction, however there was no difference in the level of factual knowledge gained. Dochy et al (2003) found PBL had a positive effect on the acquisition of skills which they considered as measuring the application of knowledge. However, where PBL was

implemented in a complete curriculum, there was a significantly negative effect on knowledge outcomes in the first two years of a course. This effect disappeared as the students progressed in their course, with no eventual difference of effect upon graduation. Strobel and van Barneveld (2009) undertook a meta-synthesis of meta-analyses comparing PBL to conventional classrooms in order to reach a conclusion on the effectiveness of PBL. They found that students and staff indicated a greater satisfaction with the PBL approach to learning than with the traditional approach. They also found that, whilst performance at exams was better under the traditional approach, when knowledge was assessed beyond the exams' true/false questions, and required elaboration, or skills requiring application of knowledge including clinical performance, then the results were significantly better under the PBL method. Watmough et al's (2006) qualitative study found that newly qualified doctors from a PBL school continued to be perceived as not having all the necessary science knowledge by their educational supervisors, although there was no such concern with the knowledge base necessary for their role. The literature around this time started to move away from comparing PBL with traditional learning and, rather, began to explore whether PBL is an effective means of preparing medical students for graduation.

A number of authors proposed that the purpose of a PBL approach is to contribute positively to the acquisition of generic competencies. Advocates of PBL identify these as personal transferable skills such as communication, working in groups (Blumberg 2000; Davis 1999; Whittle and Eaton 2001) and the development of skills in learning independently (Bate et al 2014; Evensen et al 2001). The suggestion here is that the effectiveness of PBL in helping students gain these skills gives PBL a sense of reliability in terms of preparing medical students adequately for practice on graduation. However, such views are not without their critics. Kirschner (1992) finds fault with the assumption that the way a patient presents to a doctor (with their symptoms), and how an expert doctor would then approach managing the patient (identifying a diagnosis), should not be mirrored in the way knowledge content is presented to the student doctor. Kirschner's (1992) rationale for his stance is that the strategies of experts have been developed through the slow process of

accumulating experience in their specific area, and Kirschner (1992) points out that it is not clear what benefit there is when these strategies are imposed on novice learners. Learners need to demonstrate that they have learnt in a manner that is intelligible to the experts, rather than to non-expert PBL tutors or peers. Kirschner et al (2006) believe that PBL is confusing learning in order to practice the profession, with the actual practice of a profession.

In answer to such criticism, researchers started to include not only graduate knowledge, but also their skills and attitudes. Wood (2008) regarded these additional outcomes as a more relevant starting point when researching the effect of PBL. This wider perspective on outcomes from PBL was undertaken by Koh et al (2008) and is the most recent systematic review. They explored the effects that undergraduate PBL medical education had on physician competencies after graduation. Koh et al's (2008) systematic review's inclusion criteria were research studies on graduates where PBL had been the teaching method during undergraduate training, and where a control group of graduates following a traditional curricula had been included. This resulted in thirteen studies included in the review. Doctors' self-assessment of the competencies identified were measured separately from independently observed competencies. Within the included studies, thirty eight competencies were identified and these were categorised into technical competencies (such as clerking involving history-taking, physical examination, diagnostic skills or accuracy etc.); social competencies (such as communication skills); research competencies; teaching; cognitive (self-directed learning, problem-solving, awareness of own limitations); managerial; and knowledge. Koh et al (2008) found that, when assessed by an external person, a high level of evidence supported PBL's ability to enhance development of competencies in diagnostic skills, communication skills, and coping with uncertainty. Contrary to claims made by advocates of PBL, there was only a weak level of evidence supporting development in interpersonal skills, teamwork skills, problem-solving, independence, critical thinking, time management and organisational skills and no evidence to favour PBL's ability to develop competencies such as clinical judgement and reasoning, and possession of medical

knowledge. Wood (2008) concluded from Koh et al's (2008) review that it confirmed what most educators have come to believe, that, compared with traditional learning, problem based learning has only some beneficial effects and these are on psychosocial outcomes of undergraduate medical education. We have moved towards a competency based curriculum and so comparison with traditional curricula of the 1980s and 1990s is no longer relevant. Nonetheless, the lack of empirical benefit of a more contemporary curricula has not dampened the view that education is best when interactive (Wood 2008). As Berkson (1993) points out, the effect of any education will always depend on the aptitude of the student, talents of the teachers, content to be learnt and available resources.

To establish whether key learning tasks within PBL have empirical support, the literature on small group teaching was reviewed. Bandura (1982) introduced the term 'collective efficacy', where a group has a shared belief in their capabilities when working together. A common example to clarify this concept would be in team sport or a military setting, but it has also been related to group learning within higher education. The research literature on small group learning, Stajkovic et al (2009) notes, is often focused on the resulting performance of a group, and, whilst cited in articles relating to PBL, such as Bate et al (2014), learning medicine is not a group performance activity. Students learn in groups, but undertake exams without any conferring or group work, and need to individually achieve competency in a number of dimensions. What is relevant is that if the PBL group members do not share a belief that they, as a group, are efficient, then this could have an adverse effect on the group dynamics and consequent learning environment. What is also relevant is whether cooperative learning improves the instructional effectiveness over individual learning. Slavin (1983) found that with cooperative learning, each group member requires a unique subtask for positive student achievement, individual accountability and group rewards. These three factors are considered by Slavin (1983) as essential to the instructional effectiveness of cooperative learning methods. This is quite subtle within PBL, but there are subtasks, such as 'chair', 'scribe', and feeding back to the group on a learning outcome.

Schmidt (1993) reports PBL as offering prior knowledge activation, elaboration through small group problem-analysis, and learning in context where clinical scenarios are derived from professionally relevant problems. O'Donnell (2006) explains elaboration further, saying that it is where new ideas are generated by connecting new information to prior knowledge, or combining new ideas together, and is considered a form of higher order thinking. van Blankenstein et al (2011) say that elaboration of knowledge by the individual students, within a group setting, is considered a vital component to encouraging deep learning and that it also increases knowledge retention. van Blankenstein et al (2011) undertook an experimental study of the effect of elaboration on learning and reported that listening to the elaboration, or being the learner who is generating self-explanations, are both positively beneficial to learning, although it is the process of elaborating that has persistence in a positive recall. But both processes are more positive than learners who are not offered any formal opportunity to discuss relevant topics. Evidence of how elaboration facilitates and enhances subsequent retrieval can be found in an earlier experimental study by Chi et al's (1994). They asked school children to read a short piece of text from a biology book. One group was asked to read the text sentence by sentence and explain its meaning to the researcher after each sentence, whilst another group was asked to read the text twice through with no additional task. The pre test and post test results from each group found that the students who were asked to self explain had a greater gain between the pre test and the post test. They concluded that learning and understanding of new knowledge is enhanced if the learner is offered an opportunity to elaborate on it. What was also interesting in this study was the fact that students who gave incorrect explanations still made a gain in their post test. The authors hypothesised that this was because the student, in order to deal with any contradiction, examines that piece of knowledge further and thus establishes an opportunity for self-repair.

Another aspect of group work that potentially makes it superior to working alone is the brainstorm, where the students generate learning issues triggered by the problem scenario. Diehl and Stroebe (1987) cited Osborn (1957) as the originator

for suggesting that brainstorming leads to increased quality and quantity of ideas, and providing that there are ground rules (such as the more ideas the better, and not to be critical), an individual can think up twice as many ideas when working in a group than when working alone. Pinsonneault et al (1999) also hypothesised that a group as a whole has more information than any one member, that it provides synergistic effects, and that working in a group encourages individuals to perform better. However, empirical research has consistently shown that when there is a group of fewer than nine members, people generate fewer and lower quality ideas in face-to-face brainstorm than when working alone without interacting with the group members (Chatterjea and Mitra 1976, Diehl and Stroebe 1991, Mullen et al 1991, Pinsonneault et al 1999). Reasons for these findings include evaluation apprehension, when group members may feel reticent in expressing their ideas because they worry that they will be evaluated or judged by others (Diehl and Stroebe 1987) and groups were also found to generate fewer ideas when an authority figure was present (Mullen et al 1991). Diehl and Stroebe (1987) also suggested that groups may suffer from an individual group member intentionally limiting their efforts and contributions, free riding, and relying on other group members to accomplish the brainstorm task at hand.

Empirical evidence is unable to support PBL as a 'solution' in its own right, for a stand-alone method for undergraduate medical training. Despite this, Maudsley's (1999) comment fifteen years ago, that PBL continues to survive without being affected by unprecedented scrutiny, remains true today. Sanson-Fisher and Lynagh (2005) comment that, even without empirical data, or with empirical data not supporting the claims that PBL is advantageous in terms of educational outcomes, there remains a strong perception, and international credance, that PBL represents an improvement on traditional methods.

A clear benefit offered by PBL could not be identified, and several authors have proposed that difficulties in evaluating efficacy stem from the significant variations between programmes and interpretations of PBL (Taylor and Miflin 2008; Vernon and Blake 1993). As previously discussed, and noted in a high number of literature

reviews on empirical evidence for PBL, this issue stems from PBL having no agreed instructional methods, and no agreed outcome measures (Albanese and Mitchells 1993; Taylor and Miflin 2008). Vernon and Blake (1993) suggest that the outcome variables that are the most highly valued and best exemplify the special features of PBL are often complex, multidimensional, and difficult to measure. This lack of clarity underpinning PBL can be identified as early as when it was being described for dissemination purposes. Barrows over the years used educational terminology inconsistently, for example 'discovery' and 'andragogy' were used in reference to self-directed learning, ‘problem-solving’ to describe the tutorial process and PBL was an 'approach' (Barrows and Tamblyn 1980) later a 'method' (Barrows 1984 cited by Taylor and Miflin 2008) and later still a 'curriculum' (Barrows 1985). Taylor and Miflin (2008) found that medical schools, when introducing PBL, used Barrows ideas selectively, and they gave the example of how the original concept, intended for a two-year preclinical course, has since been stretched to a five year integrative programme. Returning to Barrows’ (1984, 1985) original descriptions of PBL, this extended period of undertaking PBL is not in keeping with his views. He suggested that by the second year it may be more profitable for the student to move to individual study.

Taylor and Miflin (2008) suggest that the ideology of PBL had emotional appeal and led to an enthusiasm for its implementation which resulted in a variety of interpretations. They highlight the fact that context is an essential ingredient in effective implementation of PBL and any research on PBL is limited to the local design for a specific context which has resulted in confusing any research on PBL and limits any generalisation from research findings

Advocates of PBL frequently put any disappointing research findings down to local variations. Evensen and Hmelo (2000) believe that PBL runs the risk of becoming something it is not, through a misunderstanding of its philosophical and epistemological underpinnings, and of misapplication through the use of highly simplified methods. They say that PBL is a "sophisticated design that requires attention to learner, and to teacher, to content and to context" (Evensen and

Hmelo (2000) pxi). However, the teaching element within a medical school is often in competition with medical research and clinical responsibility and Miflin (2004) wonders if this leaves notions on adult education to be adopted uncritically with PBL being a prime example.

Norman and Schmidt (1992) say that the irony of the successful dissemination of PBL within medical education is that medicine, which is grounded in scientific method, has strongly supported PBL, despite there being no compelling evidence to recommend it over traditional learning. Berkson (1993) also highlighted the enormous effort that had gone into the conceptualisation, curricular design and faculty development in order to introduce PBL. Berkson (1993) assumes that it was hoped that PBL would fulfil more of its expectations than it in fact did. Despite all of this, there remains an optimistic view of the effectiveness of PBL, and this can only be explained by PBL being disseminated through social movement. The claims made at the outset of PBL were remarkable, and on hindsight maybe too ambitious in terms of it proving to be superior to a traditional approach. Prior to PBL, medical students would have had intrinsic motivation, and although the traditional curriculum didn't timetable in self-directed learning it is likely that students went about learning medicine in their own way, PBL is possibly just capturing and supporting established learning practices.

2.8 Medical students' perspectives of PBL

Despite a wealth of literature published on PBL, there are few studies directly exploring what is happening in classrooms, or what students' views are regarding it. My literature search, updated in 2016, identified 19 studies published in journals that explored students' views and 3 theses. This section will review the evidence currently available on students' perspectives of PBL.

Early research, such as Hughes Caplow et al (1997) and Bhattacharya (1998), have consistently documented that PBL leads to greater student satisfaction compared to

traditional learning. As implementation of PBL continues across the world, this area of study remains ongoing, as authors such as Shankar and Nandy (2014) assess satisfaction levels with PBL within their educational context. The most recent interventional study in Spain claimed that findings remain consistent with the body of evidence in that medical students' satisfaction is significantly better in with PBL than with lecture based learning (Jimenez-Mejias et al 2015). However, their PBL intervention was only a two-week duration. Newman's (2003) comments, in his systematic review on the effectiveness of PBL, that there is a limited number of high quality, robust evidence with only one study meeting his criteria for inclusion on student satisfaction.

However, the assumption that the implementation of PBL offers an improvement on traditional methods has been challenged by an interesting comparison study by Way et al (2000), undertaken within Ohio State University College of Medicine and Public Health. Ohio offers students a choice of either lecture based teaching, independent study (comprising of highly structured reading, computer based materials and diagnostic practice) or PBL. Within all three programmes, the learning outcomes, content and organ-system base are similar, and all three programmes share faculty and staff. The difference is in the teaching and learning methods. During Way et al's (2000) study, the request for the PBL pathway on entering the school was 46%. Way et al (2000) investigated achievement and satisfaction at the end of the programme and found that there was no evidence of different scoring in exams between any of the choices. Of those who chose PBL as their first choice, 40% moved onto other pathways. PBL was reported as being the most satisfactory (91%) and lecture based learning the least satisfactory (although still at 79%). Those who chose PBL and independent study pathways commented that they missed out on well-presented and organised material from content experts, comprehensive coverage, and proper pronunciation of medical terms. However, their overwhelming response was that having a choice was very important and 90% supported the school in continuing to offer multiple basic science pathways.

One significant limitation on those studies revealing favourable responses from students to the PBL process is that they often only explore junior medical students' views. It is Baroffio et al's (2013) study that has raised the concept that students' views may not remain stable over time. Baroffio et al (2013) identified that the practice of PBL evolves and, even within two years can start to move away from PBLs original intentions. Students in their study felt that there wasn't enough self-directed study time. As a possible consequence of this, as time evolved, the students were found to revert to a more expedient, superficial and, hence, less demanding approach to learning. The authors raised the possibility that fatigue may set in with the learning approach of PBL. Both Baroffio et al (2013) and Jennings (2013) raised concern that student assessments requiring knowledge details rather than high reasoning are not in congruence with PBL and its aim for acquisition of deep, self-directed learning. Baroffio et al (2013) wonder if PBL maybe perceived as arduous and complex and failing to take into account the students' workload within a medical course.

The inferences found in Baroffio et al's (2013) research back up previous research regarding a concern that PBL requires effort that is difficult to sustain, especially in a packed medical programme. Musal et al (2004) explored students' perceptions of the searching and preparing stages of the self-study process and its influence on the discussion within PBL. Through questionnaires they found that first year students, compared to third year students, had longer self-study time, and felt that the greater breadth and depth of their discussion was because they had spent longer preparing for the feedback session. The third year students, by comparison, were also more likely to minimise resources available and use textbooks for their self-study. Musal et al (2004) also came to the view that a mental weariness of the continuous and intensive efforts required since the beginning of their medical education may be the possible explanation. Visschers-Pleijers et al's (2006) study also raised the concern that setting a time boundary for self-study can lead to the students identifying it to be insufficient for the thorough preparation needed to make the feedback process effective. Hughes Caplow et al's (1997) multiple case study design examined 15 medical students' perception of their learning in a PBL

curriculum in Columbia. They set out to examine what learning processes and strategies the students were employing and what difficulties they were experiencing in implementing these strategies. They indicated that while the PBL format facilitated their learning and fostered independent and self-directed learning, the giving of learning objectives made students constantly aware of the need to acquire information as defined by those objectives.

A number of studies have explored student views on factors that affect PBL as an effective learning environment (Das Carlo et al 2003; De Grave et al 2002; Frambach et al 2014; Maudsley et al 2008; Steinert 2004; Visschers-Pleijers et al 2005; Visschers-Pleijers et al 2006; Yew and Yong 2014). Such studies have confirmed that students understand the significance of factors such as motivation, interaction, elaboration and cooperation with regards to group productivity. It was often cited that the facilitator was the key person within the group to influence the effectiveness of a PBL session. In line with this, students demonstrated a passivity regarding their own role within a session. Student behaviour will lean more towards maintaining a group harmony rather then ensuring a productive learning environment (Das Carlo et al, 2003).

Yew and Yong (2014) have recently published their findings from a large study in which 10,000 survey responses were analysed regarding students' perceptions of what makes a good or poor facilitator. Using Schmidt and Moust's (1995) framework, Yew and Yong (2014) focused their analysis of PBL facilitation on the three characteristics proposed to be the most important: use of expertise, social congruence and cognitive congruence. Regarding social congruence, factors such as the facilitator's personality and professionalism, their ability to motivate students, and their influence on the creating of a non-threatening group atmosphere were important characteristics. These specific aspects are becoming a recurring theme within studies exploring PBL through the perspective of students, underscoring the facilitator influence on the effectiveness of small group teaching. Steinert's (2004) focus group interviews concluded similar findings as did Visschers-Pleijers et al's (2006) study. Visschers-Pleijers et al (2006) interviewed a total of 50 first and

second year medical students through focus groups and found that students believed the application and integration of knowledge as a productive activity to be within the remit of the tutor, who is required to facilitate PBL by steering a middle course between the overly relaxed and overly directive.

Yew and Yong's (2014) themes identified within the characteristic of cognitive congruence the importance of scaffolding learning. This is in line with Visschers-Pleijers et al's (2005) findings where learning orientated interactions that lead to elaborations were explored. Their survey findings identified that students acknowledged that these were necessary, but reported that the occurrence of such interactions were low, leading to a conclusion that there was room for improvement in the quality of group interactions. Maudsley et al's (2008) UK based study supported these findings. Their questionnaire used open ended questions and the findings conveyed junior medical students' perceptions and opinions that, whilst PBL offered the capacity to promote a beneficial learning environment, it cannot be assumed that, in practice, it will be effective. Schmidt and Moust (1995) suggested that subject-matter expertise and social congruence are necessary conditions for cognitive congruence to exist. Cognitive congruence between tutor and students can influence the time a student spends on self-study in preparation for a session. Maudsley et al (2008) found that, where students had a naïve notion of knowledge whereby tutors and text books hold the 'Truth', the opportunities for self-directed learning within the PBL process to remained superficial.

De Grave et al's (2002) Likert scale questionnaire explored six learning process inhibitors for PBL: elaboration, interaction, participation, difficult persons, cohesion and motivation of group members. Each of these aspects can influence the success of any given tutorial, and whilst they mostly fit within Schmidt and Moust's (1995) framework, the identifying of group members as influencing or inhibiting success is additional. A lack of motivation amongst group members was found to be the most important inhibitor of the learning process, although this was found to be low in frequency. Frambach et al's (2014) study found both dominant and quiet students inhibit discussion, whereas curious and confident students enhanced it. However,

despite identifying the behaviour of individual student members as potentially inhibiting a productive learning environment, both studies identified the key role that a tutor plays in managing these situations and in encouraging a stimulating and motivating session.

A complexity within PBL emerges as individual students' perceptions of what inhibits the success of a PBL session may or may not fit with their group peers or indeed with the tutor's perceptions. De Grave et al's (2002) study was not able to identify the aspects that most inhibit the learning process because of this between-student difference in perceptions. This included differences in their individual perceptions of the tutor's role with respect to managing success inhibitors. Any tutor's influence on the groups performance is likely to be viewed differently by group members, but it has been confirmed that a tutor's behaviour does have an influence on the learning process within a tutorial (De Grave et al 1999; Maudsley et al 2008; Steinert 2004; Visschers-Pleijers et al 2005; Visschers-Pleijers et al 2006; Yew and Yong 2014).

Frambach et al (2014) explored the influence a student's cultural background may have within a tutorial group. This comparative case study was conducted in three medical schools located in East Asia, Western Europe, and the Middle East. The data collection included semi-structured one-to-one interviews of students and staff, observations of PBL tutorials, and documents about the implementation and application of PBL within each medical school. This ambitious study found that cultural backgrounds affect a discussion. Important behaviours and skills include the tradition in some cultures to not speak up when uncertain of knowledge content. Students from some cultures felt that they needed to know their group members before speaking up in a discussion. Cultural factors leading to a reluctance to share knowledge include the desire to maintain 'face' in front of the group, the hierarchical relationship with a PBL tutor, and the value placed on high achievement and competition. The implications of these findings are that a student-centred, discussion-based education method such as PBL will pose challenges in any culture because of the substantial involvement of contextual factors. However, the three

medical schools within the study have implemented PBL for over a decade, so demonstrating that PBL can accommodate such challenges.

The third characteristic from Schmidt and Moust's (1995) framework is use of expertise by the facilitator. Student evaluation of expert and non-expert PBL tutors has been the focus of two studies (Couto et al 2015; Hendry et al 2002). In Couto et al's (2015) study, senior medical students had experienced content experts and non-content experts and were asked to compare facilitation in a student evaluation using a Likert-type scale. The results found that students viewed content expert facilitators as essential to the learning process. Hendry et al's (2002) study used tutor evaluation data on 223 tutors over a two-year period and students' feedback on those that were non-experts revealed that, if the tutor was considered able to facilitate the clinical reasoning process and the group, they were just as highly rated as expert tutors. Whilst both studies consistently rated expert facilitators high, the use of questionnaires hasn't enabled a deeper understanding of why this should be. One answer could be the epistemological stance a medical student adopts. Couto et al (2015) suggest that their findings may be due to a lack of prior educational exposure to the concept of constructivism. Lonka and Lindblom-Ylanne (1996) explored modes of studying and found that medical students more often saw learning as reproduction-directed, externally regulated or was of clinical relevant knowledge. This non-constructivist epistemology may be an obstacle in developing appropriate learning strategies for PBL. Jennings (2013) had similar findings and proposed that his sample of medical students was still being assessed in traditional ways which often lean towards traditional methods of learning.

Student views of learning in PBL have mainly been examined by using questionnaire surveys. The use of questionnaires within these studies has raised some important aspects regarding students' perceptions and provided valuable information relevant to tutor development. Nonetheless, the frequent use of questionnaires leads to conclusions that are limited to the author's thoughts and feelings about the findings. The students' explanations for their responses, their feelings and behaviours have not been explored. It is not known how much thought a student

puts into such questionnaires or, more importantly, whether their conceptual understanding of the questions in the context of PBL and the underpinning theories of constructivism is the same understanding as that of the authors. Their reply will be based on their own interpretation of the question. The use of a Likert type scale, with sometimes three but more frequently five options, has the inherent problem that the space between each choice cannot possible be equidistant. In addition, LaMarca (2011) noted that the extreme option on the scale is frequently avoided students are uncomfortable with the strength of the negativity that implies, even if that indeed the choice they felt the most accurate for them.

Overall, these studies provide converging evidence of students understanding of the learning environment provided by PBL, and what can effect a tutorial productivity. However, few studies have explored students thoughts on how supportive is PBL towards their goal of learning medicine and whether it has influenced their study habits.

2.9 Conclusion

The reforming of medical education brought about the breakdown of the system whereby preclinical sciences were taught prior to the clinical teaching, and PBL offered a way of delivering this new approach of integration. Although PBL is not proving to be a superior method of learning, it has achieved its basic requirement, in that medical students graduating from a PBL curriculum are coping well in practice. Although students do not achieve outstandingly different level of success when compared to their traditionally taught counterparts, Koh et al's (2008) review provides some evidence that they do have additional assets on graduation. Whilst Sanson-Fisher and Lynagh (2005) say that alternatives to PBL should continue to be actively explored, PBL is demonstrating that it offers a means to prepare doctors for the obligatory standardised objective tests and graduate as safe practitioners, in an approach to learning that students are finding satisfying. However, the claim that students are finding PBL 'satisfying' remains fragile.

This literature review has indicated that the concept of PBL is understood in a variety of ways. It would, therefore, follow that students themselves will have their own individual understanding. Margetson (1999) comments that perception will affect practice. After three decades of literature, it seems time to move on from the rhetoric regarding PBL, and to see it for what it is - an approach to medical education that can be flexible in accommodating any necessary changes within a medical curriculum. PBL would appear to be 'fit for purpose'.

The reform was also concerned with addressing disillusionment amongst medical students, who considered the curriculum overloaded, and who identified the minimal time allocated to self-study as an issue. There was also concern that students were not being supported in developing the ability to identify gaps in their knowledge and acquire appropriate strategies and skills to keep up to date. PBL was seen as the solution to supporting students' learning just as much as it was to supporting a design for curriculum delivery. PBL's potential to provide a positive learning environment within the tutorial and motivation towards self-directed study is due to its being guided by a constructivist theory of learning. However, the divergent themes within constructivism between the individual and socially constructed knowledge can give rise to misinterpretation of the process of PBL translating a theory of learning to a transmission of teaching.

This literature review has gone below the surface descriptors of the PBL process and identified the detail of separate distinct learning opportunities that aim to foster learning. The responsibilities of the tutor have been researched but little literature has explored the students' understanding of PBL and where they see their responsibilities to be when learning medicine. A search of the literature revealed few qualitative research studies exploring PBL, and despite the students' perspective on PBL being important to its success, this review has found that a presumptive attitude has prevailed. The extent to which students understand PBL remains unclear. This study aims to build on the existing body of knowledge by exploring the phenomenon of PBL in practice through students' experiences.

Chapter 3

Methodology

3.1 Introduction

My personal experience as a PBL tutor led me to conclude that the reality of PBL was proving different from the literature. My experience was that the claims made for PBL within the published literature were not readily observable. For example, I wasn't observing evidence supporting Hmelo-Silver's (2004) claim that the PBL environment is designed to help students construct extensive, flexible knowledge that transfers to other academic and non-academic settings.

Every year I am aware of students being withdrawn from the MBBS course because they fail to reach the necessary standard to progress to the next year. Despite PBL offering tutor facilitated learning every week, there is little guidance as to how I, as a PBL tutor, can identify and support struggling students.

The review of the literature produced some recurring themes which emphasized PBL's dissemination through social movement rather than empirical findings, and with little evaluation of the student perspective. My initial thoughts were that facilitating PBL and the process of PBL was challenging, and my personal aim in undertaking research is to aid my own development and expertise as a PBL tutor.

I decided that whatever research I did, the focus should be on the students themselves and the effect PBL has on their learning. I hoped that understanding the experience and actions of individual students would contribute to an understanding of the impact of PBL in learning medicine. My motivational drive in undertaking this research was that I wanted the study to facilitate, where necessary, change, by enabling a shared understanding of PBL between the curriculum designers (the planned curriculum), the PBL tutors (the taught curriculum) and the students (the

learnt curriculum). It is also hoped that the analysis of PBL in practice may be transferable to other medical schools adopting the PBL approach.

This chapter outlines the overall research aims, and the methodology I used. It provides information on the participants, the data collection and the techniques by which data were gathered and analysed. Ethical considerations that were followed in the process are discussed and the timeline for the study is presented.

3.2 Research aims and questions

My research didn't start with a problem, but with the intention of understanding what is, and is not, happening within PBL, and what the reasons for this may be. The primary study question 'What is PBL?' aims to critically examine and explore the influence PBL has on a contemporary learning environment. The key aspect of this research is the students' translation of the concept of PBL, and their understanding and acceptance of it. I wanted to study the lived experience (Simons 2009) of students undertaking problem based learning. I felt that the way to understand PBL 'in action' (MacDonald and Walker 1975) was through the students, as they are the key protagonists in translating PBL into practice. Whilst PBL is devised by the curriculum designers and facilitated by the PBL tutors, PBL is put into practice by the students. I felt it important to interview the students involved, and observe PBL sessions. I wanted to get close to the students' understanding of PBL, and explore how they interpret, subvert and adapt PBL in relation to their own needs and experience. It is, for me, the student who is the representation of PBL.

Focusing questions for this study were:

1. How do students go about studying medicine within a PBL curriculum?
2. How do students interpret PBL?
3. How much influence does PBL have on study habits and choices?

3.3 Research methodology

I have not undertaken research previously and when deciding on an appropriate methodology, was initially bewildered by the number of different designs that might be available to me. Survey, and experimental methods are the main methods used within the body of literature published on PBL but I decided that these were not appropriate to the research I wanted to undertake. I examined various possible qualitative approaches and these included a case study, and grounded theory. However, during further reading and inquiry I learned that the most appropriate methodology for examining the lived experience of the students using PBL potential was phenomenological inquiry. This was because I wanted to explore the student's own construct of PBL and uncover the meanings behind how he or she behaves in a tutorial and how they choose to approach learning medicine they way they do.

Having chosen the overall research methodology, I then decided on the sources of data required to meet the research aims. These data sources will be described in detail below but in summary they were the following:

Interviews with a selected sample of students.
Observation of a PBL session.
Photograph of study area taken by the student.
Students' written work for their PBL group
A sample of 'note taking' by the student.
Study activity sheet for one week's duration.
Observation of a seminar.
Annual Student Feedback Survey results for 2012 and 2013.
Module handbooks covering the scenarios and weekly learning outcomes.
Students' timetables for the week they were a research participant.
The overall curriculum design for year 4.

In order to keep data manageable, the data collected focused on the students. I acknowledge that other sources, such as PBL tutors and the course director, can add further relevant information. This study does not fully explore 'why' students interpret PBL in the way that they do. The data collection focused on 'how' students interpret PBL. It wasn't until later in the fieldwork that I started to wonder why they felt as they did. Later, in the discussion chapter, I have explored some thoughts on this which are discussed, alongside the limitations of the study, in the conclusion chapter.

3.4 Selecting student respondents

My first step in this phenomenological inquiry was the selection of students. Students were purposefully sampled from the cohort of 4th year medical students who were ranked in the top quartile for their year. I do not see ranking and examination performance as the only criteria for successful studying. Training is

professional; it cannot be assumed that a student who is top of their cohort academically will necessarily become the top doctor when compared with their peers. My rationale for selecting the top quartile is as follows.

By having a top grade student, I would be exploring how a motivated student learns, with the reasonable assumption that these students will be engaging in learning every week and so be able to offer rich data in any given week during the fieldwork. Generations of students pass down their interpretation of PBL, and learning medicine, to those in the lower years, and an assumption is made that they will, by year 4, have a stable understanding of how to go about studying in order for it to lead to learning. This sampling was also chosen to act as a push for some commonalities between the participants in terms of study ability, and enable the study not only of how PBL is being interpreted by students and what influences each student in their studying in a given week, but also whether their shared characteristic of being academically successful was being attributed to the pedagogical approach.

After making this decision about selecting from the top quartile, I considered the possibility of excluding international students, students who have previously undertaken a degree, and mature students on entry. Research findings (Pecorari 2010, Richardson 1994, Richardson 1995) suggest that such students commonly adopt an approach to studying and learning that is different from their colleagues, and this may add a complexity to any analysis about studying through PBL. I also considered further exclusions. Firstly, students who have intercalated on the grounds that their reasoning behind such intercalation was unknown to me, yet may be pertinent to studying and learning. Secondly, students who had declared to the medical school as dyslexic because their study skills were often supported by known strategies and so may be considered less flexible than students who do not have dyslexia. However, after further consideration and the necessity to increase sample size, I dropped these exclusion criteria.

After initial conversations with the Course Director and the Assessment Lead of the medical school, I was provided with a list of the students who were in the top band for the written exam and the OSCE.

The resulting list was that of the potential student participants for the study. With permission, I identified which students were to be excluded. Initially only students from the written exam list were contacted via email with the participation information sheet (Appendix 4) attached. However, one student contacted me to volunteer who was on the list from the OSCE results (Table 2). Exclusion criteria led to the exclusion of two students due to specific learning difficulties, two international students, and five mature students (Table 1). The five students who responded to the invitation all went on to agree to participate A few months later further students were contacted including the two previously excluded due to being mature students or having a specific learning disability. Six students replied to the invitation and participated (Table 1). The study flowchart can be found in Appendix 5.

Table 1 gives the details of the 11 students who took part in the study.

Table 1. Purposeful sampling of year 4 students ranked by their previous end of year written exam. Inclusion, exclusion and response to invitation to participate in the study.

Rank*	Sept 2012		Feb 2013		
1	sent invite	no reply	sent invite	no reply	
2	excluded	International	excluded		
3	excluded	International	excluded		
4	sent invite	no reply	sent invite	no reply	
5	sent invite	no reply	sent invite	no reply	
6	sent invite	no reply	sent invite	no reply	
7	sent invite	no reply	sent invite	no reply	
8	sent invite	no reply	sent invite	no reply	
9	sent invite	no reply	sent invite	no reply	
10	excluded	Mature	sent invite	included	participant 6
11	sent invite	no reply	sent invite	included	participant 11
12	excluded	Mature	sent invite	included	participant 9
13	excluded	Mature	sent invite	no reply	
14	excluded	spLD	sent invite	included	participant 7
15	sent invite	included			participant 4
16	excluded	spLD	sent invite	no reply	
17	sent invite	included			participant 2
18	excluded	Mature	sent invite	included	participant 10
19	sent invite	no reply	sent invite	no reply	
20	excluded	Mature	sent invite	included	participant 8
21	sent invite	included			participant 1
22	sent invite	included			participant 3

*Yr 3 Written Results Exam Board July 2012
Female and male students identified by colour coding.

Table 2. Sampling of year 4 students ranked by their previous end of year OSCE exam

Rank**	Sept 2012				
19	volunteered	included			participant 5

** Yr 3 OSCE Results Exam Board July 2012

3.5 Collecting data sets

A flowchart of data collection for a given week with each participant can be found in Appendix 6. A summary of the data can be found in table 3 below.

Table 3 Summary of data sets

Data	Numbers	Data sets
Interviews	11	11 transcripts of between 6,000 words and 10,200 words
Observations of PBL session	4	4 sets of observations notes of between 2,700 and 2,100 words
Photographs of study areas	7	4 sets of participants photos
Students' written work	5	5 student written documents
Students' study notes	4	3 different student examples
Study activity sheets	5	5 sets of one week completed sheets
Seminar attendance	4	4 set of observations notes of between 900 words and 1,800 words

Interviews

Prior to seeking consent to participate, all potential students met the researcher and they were informed of the aims and nature of the study. This included the likely duration of their involvement of one week, the likely duration until completion of the study (two years), and an opportunity to ask questions about the study.

A semi structured interview was one of the main methods used in order to gain an understanding of a student's approach to studying through PBL. Gubrium and Holstein (2002) identify interviewing as appropriate when the research is aiming to explore a personal lived experience that is not readily articulated, and where there can be multiple perspectives. Using a semi structured approach to interviewing allows students a degree of freedom in their replies in order to identify aspects of PBL that have relevance to them, yet within a structure set by me. The aim is for this method to provide comparable qualitative data amongst a number of students. The decision to interview as the main method of data collection also reflected the value I placed on personal language as data. Banfield (2004) raises the issue that

face to face interviews construct a perspective there and then, rather than offering an accurate reflection on reality. However, my view is that it will reveal knowledge of the student's academic world that exists and is constructed by the participant student prior to the interview. Nonetheless, Denscombe's (2014) point on what is termed 'the interview effect' may have relevance as there may be a bearing on the amount of information students are willing to divulge, and how honest they are prepared to be about what they reveal. While it is impossible to fully evaluate the 'interview effect', face to face interviewing can allow some measure of evaluation relating to any pauses and hesitancy students may have when talking about a particular issue. Patton (2002) raises another aspect of the limitations of semi structured interviewing in that topics may be inadvertently missed. Lengthy consideration of the aspects that would answer the research question are shown in Box 1 below and the final semi structured format can be found in Appendix 7 with the aim to minimise this risk as much as possible.

Box 1 Potential areas for exploration in the interview.

Intrinsic Motivation:	**Study Approaches:**
I assume that they are on their own?	What is it that students do when they write up a PBL topic?
Role of others in a students learning. Use of collaborating with other.	What sources do they look at, and in what order?
How do they plan?	How do they find references?
Learning process facilitated by the tutor.	How do they go about reading, and extraction of information and note taking?
Explore text strategies.	When do they move from reading to writing?
Explore examination strategies.	Do they have a routine pattern or are they flexible?
What is PBL good for?	Do they do drafts or notes?
What is it not good for?	Explore time management.
Does it help them learn?	Explore if they are image conscious of their work.
What do they think others do?	How much time do they spend studying at one go, and the total for a week.
How important do they associate the written piece of PBL work to learning?	How do they document their learning leading towards the written PBL?
	What are the logistics? Pen/paper, time thinking, use of library, resources drafts etc.
	Do they have study partners?

At the end of the interviews, I asked if there was any aspect that the students felt I had missed. The students commonly highlighted that, for them, PBL has a context which is as part of the course. The students were having to maintain a dynamic relationship amongst a number of different course components and demands, and

whilst they can talk about their relationship with PBL, they also have a holistic view of the course, of which PBL is an important part. Interviewing can also lead to the opposite of the omission of relevant aspects, rather, leading students to describe perceptions they would otherwise think irrelevant. Despite the importance of these limitations, which may occur despite careful consideration, semi structured interviewing is an invaluable method because of its ability to provide original voices on a topic, and offer the opportunity to comment without inhibition. One final important aspect of interviews regarding their ability to generate rich data, is that their effectiveness is dependent upon the communication skills of the researcher as much as those of the participant. Clough and Nutbrown (2012) explain that the basic set of skills required include clearly structured questions, attentive listening and appropriate probing and prompting, all with the aim of encouraging the participant to talk freely. My own interpersonal skills have developed over my years as a health care professional, including my ability to establish rapport and trust. Nonetheless, following my first interview, I met with my supervisor in order to reflect and consider professional development as a researcher.

All interviews were taped to ensure that the data collection was accurate, and each interview saved in a digital folder downloaded directly to a computer, and a backup made of the original data. The data from each of the eleven participants was fully transcribed. Transcribing allowed me to examine whether biases appeared in my questioning, but also importantly, ensured accurate reportage in my documentation of the findings. Soon after the interview I transcribed it and wrote my own reflections on the conversation in order to allow good recall of the nuances.

Observation

Data collection from each participant in was researched over a period of one week. If the participant's PBL group consented to being observed I would start the participant's researched week by attending and observing the whole of their PBL session. A one-to-one interview with the student took place one week later, on the day of their next PBL session. This offered an immediate retrospective discussion on how they went about studying and learning their learning outcomes for that week.

As a companion method to the interview, I observed the PBL session in its natural loci. My observations are my voice to the study and were used as a form of collaborative research where I offered a context for interaction with the participants. The descriptive observation yielded a large amount of data as I annotated and described the session. I didn't attend the session with a checklist of what I was to focus my observations on, but followed the structure detailed in Box 2.

Box 2 Structure and guidance for observational field work

Describe the setting - room layout, where the tutor is, where the projector is in relation to the students etc. Identify the characteristics of those present - gender, role during the session i.e. Chair, scribe, student member and tutor. Describe the content of any activity or intervention - teaching, activities or messages delivered. Document the interactions - between students, tutor to student members, student members to the chair, and student members to the peer tutor. Describe and assess the quality of delivery of teaching by the peer tutor. Be alert to unanticipated events.

Whilst I aimed to take the stance of an observer, I did at times become a participant, though only at the group's invitation. The members of the first participant's group did not all consent to my presence but I was given consent to observe the session for the next four participants. The benefits of including observation as data was that I felt I had some predetermined idea of how an 'A' grade student would behave in a PBL session. Without direct observation, such assumptions would not have been challenged and tested. However, there were times when my role as a researcher blurred into my becoming a part of the community I was observing. This raises an interesting point regarding who is the

best person to investigate PBL. PBL is difficult to 'explain' with any confidence. There is no consensus on how it should be designed and run in sessions. The influence of the tutor and each student can affect how it is run and what happens. I am part of the PBL community and feel that my understanding of the context which allows me to have a foundation of knowledge which is valuable and allows me to focus on the norms and values that are part of that specific PBL group's culture. Another important reason for observing the PBL session was that it offered me an approach, when listening to the student participants, to understanding the students' perceptions, offering a process of sharing of knowledge that is more reflective, as the participant and the researcher have some common ground as a starting point. Observational data is useful in this study as PBL is a situation whereby contextual conditions of the PBL session are critical. However, observation has its disadvantages as a means of data. Observer bias may lead to the recording of aspects of relevance to me personally, or the recording of my interpretation of what I have understood as observing, which may not be a student's interpretation. Observer effect can also occur whereby my presence influences the behaviour of those being observed. My aim when observing was to be no more of a distraction than the PBL tutor's presence already was. I didn't audio tape or video record the student's PBL session purposely so as to minimise the observer effect.

Photographs

The participants were invited to take their own photograph of their study area. The aim was to add insight and understanding to the student's interview by adding insight and understanding that might be missed when only relying on the interview data. Pink (2013) explored the relationship between visual and verbal knowledge and found photographs added meaningful links between different research materials. She argues that photographs represent within themselves a different type of knowledge that may be understood in relation to other data collected. It also offers the participants the chance to be engaged in the study that is about them. However, the analysis of the photographs without any accompanying text or title proved difficult. My aim in using the photographs proved not to be as clear as it might have been. Berger (2008) identifies that the photographer may have specific

purposes and intentions for the photograph which may be interpreted differently by the viewer. Similarly, the researcher and the student photographer can have different interpretations of how the photograph may be used for research purposes. Written statements that complemented the photographs would have helped create the context for understanding. Nonetheless, the resulting photographs offered a visual observation of where the participant studies and were an illustrative end in themselves: direct observation of an aspect of a participant's academic world.

Students' written work

Relevant documentation was made explicit in the data collection plans and included the student's written work produced for their colleagues each week. Such documentation was collected with the view that it would corroborate and augment evidence from the interview and observation. The written product can be seen as one of several methods whereby students publicly demonstrate their understanding of a medical subject within PBL. There is no 'competition' in producing these documents. They are also not part of any summative assessment, although the tutor uses them to assist in writing up a formative report at the end of each term. These textual records were analysed as an expression of the interaction between the individual who authored the work and their group. I was exploring a complex literate social world and to do so without any written texts would have been to miss out on that perspective and not do justice to the academic world I was aiming to explore. Silverman (2011) comments that documents are 'social facts' in that they are produced, shared and used in social organised ways, and suggests that we approach documents for what they are and what they are used to accomplish.

Students' study notes

What had not been planned in advance was the collection of students' private note taking. It became apparent that the participants placed significant value on making notes during personal study and a copy of such notes, with the student's consent, was also collected as a source of data. The written product was a prepared topic for the purpose of collaboration whilst note taking demonstrated how they went about

learning a topic. There are a few ground rules pertaining to the written product, for instance its length, how to reference, and a deadline for making it available to the group, but there are no preset rules for learning the topic. Therefore, both of these two textual documents were deemed important data.

Study activities sheet

The participant was asked to complete a study activity sheet that documented what time of day and for how long they studied during one week. This quantitative data can provide information relating to what the student participant spent their time on, time management, and comparable information between one participant and another. It could also provide an opportunity to study trends alongside the curriculum timetable. The disadvantage with such data is that they can be incomplete and inaccurate. Time spent studying may have participant bias and effect similar to the issue with data collected through observation.

Seminar attendance

The researcher joined the participant's class for one seminar during the week. I was primarily interested in PBL but the influence PBL has on the student's learning must be, in some way, affected by the seminars. PBL is based around self-study and learning from peers, but seminars offer another approach to teaching. This pedagogical hybrid within the curriculum was considered important and observation data, gathered by being present in the audience with the students, allowed this aspect to be included within the overall research.

Other sources of data

Additional sources of data, less directly associated with the participants, were also collected. Annual student feedback survey results were analysed for the participant's whole cohort; the participant's timetable; documentation of the PBL scenarios and learning outcomes; PBL tutors' handbooks; and an overview of the curriculum design for year 4 were also part of the data and informed the analysis and interpretation.

Monitoring the research process

Each participant was studied over a period of one week with the interview scheduled at the end of that week, just prior to the PBL session that would involve their feedback on the weeks learning. The PBL process at NMS has been described in more detail in Chapter 1.5.

Early analysis of the first few interviews was, unexpectedly, indicating that students were experiencing a degree of conflict. I wanted to increase the number of students that I interviewed to establish whether this was an issue that was widespread or just an issue for a select few. The exclusion criteria I had initially considered wasn't supporting the claim that PBL influenced study habits. Therefore, in order to increase the data collection, the exclusion criteria when recruiting further participants was dropped except that the students were still to be in the top quartile for year 4.

Research-generated materials including a reflective journal, methodological logs and analytic memos were maintained during the four-year period of researching and writing this study. These processes enabled me to keep account of the many tangential threads that were emerging and to explore personal, methodological and epistemological issues, and also served as important references for the audit trail on this study. A focus on the reflective journals enabled an exploration of the students' perspective and the journal itself offers a record of how their perspective played a significant role in changing my perspective and understanding of PBL. This personal journey informed the critical analysis of learning medicine through a PBL curriculum. I have included this evolving understanding of PBL alongside the interpretation and discussion of the themes and also within my conclusion.

3.6 Data Analysis

Participants' real names were changed to pseudonyms which, to the researcher, appeared to offer an 'equivalent' name. The names reflect gender and similar

cultural influences to the real names of the participants. All participants were informed that their data would be anonymised.

In order to assist with data management, each interview transcript was initially 'paragraphed' into individual short narratives and then each narrative was assigned a chronological number. For instance, the interview transcript narratives of the first participant to be researched, Rebecca, were separated and numbered 1 to 76. This was followed by Jennifer whose transcript included narratives 77 to 142, and so on through all eleven transcripts. Further analysis often led to the longer narrative paragraphs being split down into smaller narratives, identified by adding a number after the decimal point for instance 177.1 and 177.2.

I started to attach labels to the data as I went along, so Rebecca's interview was the first to be coded. I had anticipated that the coding would be underpinned by the literature on PBL, particularly by the claims that PBL makes regarding learning, whereby I would start to understand the data through theory relevant to PBL. However, this foundational work did not prove to be appropriate. The students were not as aware of the theoretical framework of PBL and they were responding with their own epistemological lenses. Each narrative suggested being assigned to more than one code and an analytic memo noted:

Interaction between the student and their approach to learning is not occurring in neat isolated units. Some segments are descriptive and some are inferential. Whilst I don't want to appear indecisive in my coding method, I want to remain open to possibilities.

Analytic memo 7th April 2013

As more data were being collected from more participants, it became clearer that the interview transcripts were better coded with an inductive approach. I wanted to focus on the students' engagement with learning medicine and their translation and acceptance of PBL. The act of transcribing allowed me to identify a dissonance between students learning the PBL way and those learning despite the PBL way, so to focus on prior codes seemed the wrong method. Staying with an inductive approach, more themes began to emerge. These themes had not been anticipated and the trade-off between not concentrating on prior PBL theories but looking at the data completely fresh felt justifiable because it was the student's perspective that had been a key feature in the design of this study. This unanticipated event led to repeating the process to recruit participants in order to explore themes emerging with more confidence.

It is recognised that an inductive approach does not lead to direct access to the students' perspective as my personal perspective has directed the interpretation and analysis of the data. However, by adopting and maintaining a first person perspective during the data analysis, I hoped to ensure that I remain as close to the participants' understanding as possible.

Once the transcription of the interviews had got underway, I started to code them. The codes were a word or short phrase that captured the behaviours, processes or beliefs of the participants (see Appendix 8). My codebook became a work in progress right up to the point at which the research was almost completed. The content of codes were refined and the description became more detailed, and the coding methods themselves were part of the analysis.

While I was exploring specific coding methods suitable for my data, I came across Saldaña's (2013) dramaturgical coding method. This method, Saldaña (2013) explains, attunes the researcher to human reaction, interaction and management of conflict. It is generally used in explicit dramatic performances, but these can include any scenario involving an unfolding production that asks for performances. PBL is a context whereby the students are interacting and reacting to the PBL way of

learning. They are observed as they do so by their tutor and by others in the group. This coding method allowed an additional layer of analysis by comparing the students' individual objectives and tactics with the objectives of PBL. These additional codes led to a deeper understanding of the conflict that can arise within a PBL curriculum.

Both the data and the research questions were returned to repeatedly during the coding stage until no new codes were emerging. At this point the analysis process was assisted by systematically coding all the data with NVivo software (see Appendix 8). Second cycle coding aimed to achieve higher level themes and this process occurred alongside the continued writing of analytic memos (see Appendix 9 for an example). The result was that overarching themes were starting to be narrowed down to major themes, with the codes associated with the themes providing each theme's core components. In order to undertake the second cycle coding, the interview data was returned to once again to choose extracts for further analysis. Analysing the codes with the narratives drew out further meaning from each theme. This process built hierarchies within each major theme and there was a transition from coding to a more conceptual level of analysis. To ensure a representative sample, all the numbered narratives from the original pool of eleven participants were considered for a second time. Each narrative was considered in terms of its capacity to be considered as typical or atypical, to support or to contradict outright until extracts were chosen for the final analysis. These extracts were considered as offering something distinct and interesting about the theme. Their meanings and understandings were already implicit and the interpretation was to explicitly unpack, draw out and amplify in order to add value to the implicit content of the extracts. By doing this, the narrative shifts from being a personal one to the participant being illustrative to the theme.

During the process of the first cycle coding and again, and in more detail, with the second cycle coding, the additional data sources were analysed. Some of the other sources were directly related to the embedded unit of each student. These sources became a critical part of testing the key propositions that were emerging. An

example of this involves an initial code of time management that was articulated with frequency both within one student's narrative as well as across participants. Using multiple sources including the campus timetables, the study activity sheets and the PBL documentations, the importance of time and managing it in order to gain the most in terms of knowledge led to a fuller analysis than the interview data alone. Other sources, such as the photographs, facilitated the building of explanations.

The analysis of data also used the multiple sources to ensure that rival explanations that were emerging were appropriately critically considered. For example, my own observation field notes during PBL sessions were important when analysing the contrasting perspective emerging from the student's narrative. Observational data was indexed and then analysed after each stage of the interview data. The main coding method of the observational data followed De Munck and Sobo's (1998) suggestion where the interview coding is used to offer a framework to organise the observational coding in order to select, cross reference and emphasise information being generated. The observational data and the interview data combined to help make sense of the behaviour of the participants in the session and in their self-study. Data from the other sources also followed this method and added a clarity that would not have been possible with only one source of information. The overall analysis, once it had all been organised in this way, allowed a construction on the final themes to be a reflection of multiple sources of data and narratives from all the sources are used within the presentation of the data.

The insider-researcher during fieldwork

Being a PBL tutor gave me a social ease and offered a shared community membership with the student participants. I had an understanding of the language used by the students to describe and explain PBL. Any stress regarding disclosure was minimised by my not being a stranger to them, and it also helped that I am not a medic myself, which I believed offered participants the freedom to share their experience of learning medicine without the fear of being judged. The students were also aware that I had no authority with regards to their progression on the

course. However, I needed to be mindful that the commonality that we had did not lead me into making assumptions on their behalf, but that I remained open to the students' expression of their understanding of PBL.

There were times when the student participant took the role of informant, rather than respondent, and in doing so offered me their interpretations and conclusions which could, if not identified, lead to greater weighting of their content. For example:

Rebecca: I don't think it's making me anymore [paused] I haven't suddenly gone "oh PBL's great". I think everyone is, sort of, at the point now that we are not interested in presenting, not really. (I1.10)

During the fieldwork, I became aware that students were experiencing a degree of conflict towards PBL. The students knew that their view wasn't common knowledge to tutors and they wanted to have a voice. For example, Marion expressed a therapeutic sense of unburdening:

Marion: This is cathartic! (I10.600.2)

I gathered as much detailed information as possible yet in making this 'choice' the students' perspectives were affecting my research. Frankham and Smears (2012) identify that choices are made throughout the research process, and are essential to it, but raise an awareness that a researcher can also 'choose not to choose' and, by doing so, allow an opportunity to witness what may come into view.

Simons (2009) appraises that our 'self' in research is not static and that multiple selves emerge at different times in relation to different research points. The students' descriptions of conflicts were being identified by my PBL tutor 'self' who had also experienced personal conflict with PBL, and also my 'political' self whereby I was emotionally engaged towards the students' critique of PBL. Such feelings will filter and shape the data being gathered. This is not to say that there is anything

wrong in this as it will lead to a distinctive contribution, but I do recognise that I am part of the main instrument of data gathering and my being an 'insider' also plays a significant role.

The insider-researcher during analysis and coding of the collected data

I became mindful that my empathy for the students in the early stages of fieldwork was leading me to identify with them, rather than trying to be analytical about what they were saying. In order to stay close to the participants through a mutual rapport and provide a conduit for the students' understanding of PBL, I was placing myself as if 'inside' the students' shoes. This was not the 'empathic neutrality' Ritchie et al (2014) identify as necessary. Two research journal extracts over a period of time demonstrate this personal awareness:

2nd October 2012

*Reflections following case study 1**

Goal of SDL is quality as well as quantity in students' learning - This was the aspect I was most impressed with by CS 1. I thought she really was getting quality and quantity, in fact more quantity than implied by the weeks LO. She felt she had to go beyond the learning outcomes, that they were too specific and narrow for her to understand where they sat in the wider picture.

[*Initially I referred to data sets for each student participant as 'cases']

Extract from research journal

14th April 2013

Attended a post grad session at UEA on data management and data analysis. The tutor re-emphasized that we see our data through our epistemological lens. …. My data isn't real, it is my construct of the student participant construct. She said that 'education' literally means 'to lead out' i.e. bring out what is in you, but the common interpretation is about placing info into students as if they were a bank and needed money put into them. The data needs to be interpreted and this should be critical. Don't take it at face value. Are the students defending themselves? Analyse it, do not romanticize it.

Extract from research journal

It was important for me to recognise that my 'insider' status could impact on data interpretation. My interest, was drawn towards the conflict students were describing, although they did not themselves use the word or term 'conflict'. This was my interpretation.

I recognised that I needed to 'take a step back' from these tendencies to over empathise and whilst I intended my interview approach to foster an honest disclosure, in as far as anyone could as an insider, I needed to develop an interpretation that took account of my insider status but did not become constrained by it. To be neutral about the disputes the student participants had with PBL would be impossible but I needed to be mindful of not imposing my 'self' too much in the research. Clough and Nutbrown (2012) describe the goal as being to provide as 'faithful' an interpretation of what is heard as possible. In order to achieve this, I remained actively listening within the interview and reflected on my responses during the interview when I played back the taped recording. During the analysis, I reflected on my reactions, and whilst my insider status offered strength in collecting the data, remained mindful of the problems it could cause in interpretation of the data. I focused on the concerns and cares that the students claimed for themselves and contextualised these with the aim of offering a wider perspective of PBL from that which is presently known.

3.7 Ethical Considerations

The proposed study is a complex research design that involves university undergraduate students and I received ethical approval (Appendix 10) prior to commencing any fieldwork. During the fieldwork, the initial analysis found that all the participants were being more diverse with regard to organising their week's studying, and that the PBL format was not necessarily being followed. The findings raised a question mark over the reason for the participants' volunteering. Did they volunteer because they knew they had something 'interesting' about PBL to tell? Ryen (2011) believes that participants are instrumental in having their own agendas and goals and that these can bring with them emergent challenges. Following discussion with my supervisor, I returned to the Ethics committee to seek approval to interview more students. This phase of the research consisted of student interview data collection only. The amendment required revised participant information sheet (Appendix 11) and revised consent (Appendix 12) form. Ethics confirmed in writing their support for this amendment.

Fieldwork began in September 2012. Students who met the criteria were sent, via email, a letter of invitation (Appendix 13), and a participant information sheet (Appendix 4). Students who expressed an interest were met on a one-to-one basis and their contribution to the data collection was explained before they consented to participate. They received a hard copy of the study activity sheet (Appendix 14) to complete for the week of their data collection. Individual consent forms were signed by each participant before the interviews were recorded. The participant's PBL group and the tutor were emailed in advance of the proposed session and the participation information sheet relevant to them was attached (Appendix 15). Students were advised to contact their tutor if they did not wish for their session to be observed. Neither the student nor the tutor were required to give a reason for not consenting and their identity was kept anonymous from the study participant, the PBL group members and from the researcher. The tutor informed me whether there had been unanimous agreement or not. Where there was agreement, consent

was obtained from all members of the group immediately prior to my observing the PBL session (Appendix 16).

A system of documentation and storage of data was kept by me, the researcher. The main documents, such as the audio interview and its transcript, photographs, observational records, and analytical notes were predominantly kept electronically, the remainder being paper files. Major data records were routinely duplicated and stored in more than one file. All collected data were used for research purposes only. Only I had access to the data. The data were kept on my password protected personal lap-top, and on a personal external hard drive as a backup, and hard copy data were stored securely at my home. All names of the students were changed. However, since the study is located in a single medical school within one university, there cannot be absolute anonymity, of which the participants were made aware.

An ethical issue that required consideration was my position, within the course, as a known member of the teaching staff, with a responsibility for ensuring quality of teaching. The fieldwork overlapped with this paid employment. The extract below is an example.

Marion: "We had a PBL tutor in the first year who was a psychiatrist. He was good, but was incredibly demanding. My third year we had a GP, she couldn't keep up linguistically, she was German and she couldn't follow. This is another issue really, it's like, who's teaching us? Our PBL tutor at the moment, lovely woman, obviously academically very experienced, very knowledgeable, but the questions that she asks are completely irrelevant, and she doesn't know they're irrelevant. Why are we wasting time on this? And she doesn't guide us intellectually, or in terms of medicine, in the slightest." (I10.605)

I was mindful prior to commencing the fieldwork that I would be required to acknowledge both the responsibilities and sensitivities of a researcher as well as those of a tutor. My aim was to manage any issues in ways all parties would consider ethical. Ethical issues are more complex when the students are

participating in research where it is not clear within the week where participation begins and ends. The first five students participating were contributing to the research other than just by being interviewed and this greater level of contribution may not have been what they initially thought they were consenting to. In order to address this, there was careful discussion prior to consent, and an ethos of consent being ongoing and renegotiated between researcher and researched throughout the research process. To illustrate how this was carried out, the interview was scheduled at the end of the studied week. The students arrived with their collected data, such as photos and study activity sheet, and this offered the opportunity to further explore consent. A few participants offered a variant of the requested documentation, such as photos of their notebook writing as well as their study area. Their understanding of why they were presenting such material, and how it would inform and be used within the research, was explored. I was very pleased with the engagement the participants demonstrated but also mindful of the responsibility that this brings, and studying participants in a naturalistic environment resulted in some ethical issues that were not anticipated. During the fieldwork, some participants emailed me during the week, and following the end of the week. Such exchanges demonstrated to me that there was no clear cut off point as to when participation by the student ceased. A connectedness is crucial to fieldwork but can pose ethical concerns. Emergent dilemmas were contextual and called for a situational response, and offering a separate meeting where I could return to my role as a tutor was both acceptable to the students and to me as a researcher and tutor.

Consideration was given to the possibility of the study's locality remaining anonymous and the implications if this were not possible. It would be difficult to achieve true anonymity yet include details of my role within the school where the fieldwork was carried out. My exposure to PBL was on a par with the students. They had been exposed to it for four years as had I. The students knew me to varying degrees and my being part of the community would had an influence in participants' responses. An aspect I felt was important to include. This research has aimed to build on the literature surrounding PBL. Part of this process has been to

analyse and critique the literature based on study findings. Such an approach should be viewed as desirable within the research community, and whilst the findings offer a critique of the current perspective on PBL, it does not criticise the location nor the way they deliver PBL. With ethical approval from the university, the participants' anonymity will be protected but the ability to protect the location of the study was felt to be impossible unless important details were excluded. The implication of this is that strong advocates of PBL could suggest that the school itself is not appropriately problem solving. For example, Dolmans et al (2005) argue that problems encountered in educational practice 'usually stem from poor implementation of PBL' (p732). They criticise some research where the findings are not fully advocating PBL by pointing out faults in the research design. This is another implication that both I and the school could face. Interestingly, they do go on to recommend a design by saying that research on PBL should focus on "theoretical concepts underlying PBL" and be aimed at "a clearer understanding of how PBL does or does not work and under which circumstances" (p739). They go on to say that research needs to bridge theory and practice, and be designed to make use of mixed methods, and the triangulation of multiple sources and types of data. It should not rely on a single method or a single source of data. I feel that as both practitioner and researcher, my research contributes to the body of knowledge on PBL.

3.8 Timeline

Permission to begin research with undergraduate students was granted by the Ethics committee in July 2012. Data collection took place over a period of seven months within the academic year of 2012/2013. The first set of invitations went out in September 2012 and data collection of the first participant commenced in the same month. The second recruitment stage occurred in February 2013. Each interview was transcribed as soon as possible after collection. Detailed data analysis started in April 2013 after all participants' interviews had been transcribed. Data analysis was further considered with a background framework of the literature on

PBL and this commenced January 2014. Emerging themes were presented and explored with my supervisor during 2014. The dissertation itself was written and revised from 2014 through to 2016.

Chapter 4

The Economy of Knowledge

4.1 Introduction

Three major themes emerged from the detailed analysis of all of the data and respond to the three research questions of this study: How do students go about studying medicine within a PBL curriculum? How do students interpret PBL? How much influence does PBL have on study habits and choices? In answering these questions the themes also offer insight into PBL itself and the next three chapters uses this insight to offer an explanation for the rapid dissemination of PBL and how the claims made of PBL in the literature are at odds with the findings in this study. It was important to me to ensure the voice of the students came across clearly and with minimal interference. Therefore I have chosen to use the students' own words through selective extracts throughout the chapters detailing the study findings. However, as Watts (2013) emphasises, the extracts only demonstrate the presence of a theme, so the quality and meaning of each extract is offered through my interpretation which includes the influence of relevant literature.

The first theme is about knowledge. Students were aware that knowledge is an asset when competency is a major outcome of knowledge production.

Anika: You just want to know the information. You can say ‘I can read it up’, but, I don’t know, if you are young, and a girl, they will just think “oh my god what is she doing?” (I5.262)

The success of an individual is often underpinned by their ability to learn. Knowledge can be privately owned or used as a commodity and these aspects were termed 'knowledge economy' by Drucker (1969) and refer to the fact that the most productive, fastest-growing sectors of all economies are knowledge-based. This study highlights the importance of acquiring knowledge. McLoughlin (2009) wrote

that there is no greater nightmare for the intending physician than the prospect of failing at medical school. Even when successful in training, on graduation, medical students in the UK are ranked by their examination results, with superiority being directly equated to the ability to learn and recall knowledge.

4.2. Knowledge as a commodity

Fourth year medical students were aware of the expectation that they would become increasingly knowledgeable and that this required a significant and consistent commitment to study and learn.

Hazel: I want to learn because I know we are going to get examined on it at the end of the module. Also I don't like to go to secondary care and it looking like I haven't bothered; If somebody asks me something I want to at least be able to say something semi-sensible, and if they say "well no that's not right" then that's fine but I don't like to think I haven't done any work. (I4.204.1)

There are two aspects causing Hazel concern. The first is the fear of failure and the second is the fear of shame, or a loss of standing. What people think of us is important. The main purpose of knowledge during undergraduate medical training is for patient care - a doctor uses knowledge to provide a service. But this also comes with responsibility and can lead to a fear of doing harm through ignorance, and a fear of negative evaluation from professional colleagues.

Jennifer: I like having the knowledge. I feel I'm quite fortunate to be studying for the profession. I quite enjoy learning about the human body. Sometimes I think "Oh it's too much knowledge, too much for my head", but I feel responsible that I need that knowledge for my job. So I think that's quite a big motivator for me. I don't want to become a junior doctor to find out I'm injuring people, or all my colleagues think I'm absolutely rubbish. I don't want people to think of me like that, and I don't

want to put other people at risk because I haven't been bothered to learn something. (I2.137)

Isobel: I am so conscious of what I don't know, and how that might impact on somebody. Someone comes through the door and it's something I don't know about. That is why I try not to miss lectures and things, because I just think "what if that's the day someone comes in and I didn't go to that lecture and then I don't know about it and then something bad happens?" Which is ridiculous because I know the system doesn't work like that. It's not going to ever be reliant on me, or not for a long time anyway. But it's all part of my complicated madness about [didn't finish the sentence] (I6.458)

Isobel's equivocation here is interesting; the fear of doing harm persists despite a rationalisation. Although acquiring knowledge is understood by medical students to be a constant goal, during training, fellow colleagues seem to strike a complex balance between success, maintaining self-esteem and avoiding direct competition.

Jennifer: I feel as though my peers wouldn't say "Oh Jennifer's really clever". Just because I don't really like to come across as one of the clever ones, and I don't even feel clever myself. But obviously my exam results reflect that I'm obviously quite intelligent. But I don't necessarily feel as if I'm any more intelligent than all my other peers, so it always shocks me that I get a good result. Because I just think I'm learning what everyone should know. So obviously I'm doing something right without really realising it. (I2.121)

Hazel: I hate doing things which I don't think are the best that I can do, and I know that a lot of people don't read what I produce. I think more people don't read PBL than do in the Med school. But I like to think that if anybody did choose to read it and then somebody asked me a question on it they wouldn't be laughed at because I'd done an awful piece of work that they had put their trust in. So yeah, I do like to work hard on it, and also because if I'm going to do a piece of work then I may as

well get something out of it myself. I think that's why I often spend a bit more time on it. (I4.213)

Hazel's written product submitted during the researched week demonstrates a well-considered, well executed piece of work that had been sourced widely (Appendix 17).

A number of the students in the study had faced academic obstacles, either during their A levels or prior to being accepted into medical school, which had led them to reflect on their studying and, at times, seek assistance. Mcloughlin (2009) noted that students who were failing medical education often had no experience of being academically stretched prior to entering medical school, so had not experienced a need to change their study strategies. My study's inclusion criteria of 'A' grade students offers support for this reflection.

Rebecca: When I did my re-sits, I went to a crammer (which is a bad thing but anyway) and I learnt how to learn things for myself rather than from anyone else. I find it really difficult to have to use other people's work and their interpretation of something, their understanding of it, because actually it means that you don't have to think it through and learn it. (I1.12)

Jennifer: I struggled picking up Chemistry at first and I went to one of these homework help things after school one day and the teacher asked me "so what kind of grade are you planning to get for your A level?" So I said, (aim high) "get an A" and she was like "from what I've seen so far, and you want to be realistic, I would probably aim for a C, but be very happy if you got a B". And so from then on I was kind of more motivated about what I have to do. Have to do well just to prove her wrong as well. (I2.78)

Jennifer: I just worked hard at everything, tried to just understand it and I thought, if I could get the understanding. (I2.79)

Hazel: I think it made me realise that I wasn't going to get by without putting in any effort and that I could get by if I did put in the effort. I took four out of the six biology in my last sitting so that was two thirds of the A level because I hadn't passed any of those modules, and I got A's in all of them. I had an even bigger workload than I had ever had before but I did much better than I had ever done before, so yeah I think it made me realise that just a bit of work would make me do a bit better. (I4.188)

These students are indicating that they have learnt, through experience, what working for success feels like. They know how much and how hard they need to study in order to achieve a successful outcome, and this turns out to be a very important lesson to learn.

4.3 Is being 'good enough' good enough?

How much knowledge is needed? Students identified that the time spent on learning was an investment, as more knowledge increased the likelihood of being successful.

Hazel: I get stressed. For example, if my boyfriend started to be like "oh shall we go home for the weekend?" I would find myself in a really stressful position because I would know that I wouldn't be able to do as much as I would normally. I'm not very good at taking time off. My friendships at home have really suffered because I don't go home during term time, because it is six hours on a train to get there, and it's worse returning on a Sunday. And if I go down to see them it would just be going out drinking, where you catch up with your friends, and I would be exhausted, and I just wouldn't be able to cope, and I would find that a really stressful prospect, and they really don't understand. I think that they think that I think that my degree is more important, which is just so far from the truth. But the consequences of not (for me) the consequences of not doing the best that I can are worse than anything else. I suppose it goes back to the OSCE, if I felt that I had done all this stuff then not

do well. And also I feel uncomfortable at the time. I really struggle you know, I want to go home for the weekend, I always miss my parents, <pause> but if I got a band C in my OSCE I would be like “oh, if I just tried a bit harder and spent less time mucking around". (I4.216)

At the present moment, success for Hazel is not about achieving a work life balance, but about being focused on achieving a top grade in the MBBS programme. Knowledge scores numerical points which in turn lead to a rank where a student can compare themselves amongst their fellow peers. Hazel is demonstrating Cees van der Vleuten (2014) point that for every evaluative action there is an educational reaction. So while clinical assessments enable course leaders to make decisions about a student, assessments can also be used by the students themselves as a source of information, especially if the students see the assessors as clinical experts.

A number of students perceived the 'core' curriculum knowledge (the learning objectives) as the minimum accepted standard and therefore, they argued, they should aim for more in order to be a 'good' doctor.

Jennifer: I also look at the seminars and lectures and structure my learning around them because I don’t think the learning objectives always cover what I think I probably need to know to be a good doctor.
Researcher: Right.
Jennifer: So although I say I base my learning on the learning objectives I think in my mind I want to know what will make me a good doctor rather than what I need to know to pass my exams. (I2.85)

Rebecca: And it’s knowing things outside of. So everyone knows the basic stuff, and you get that from your lectures, you get that from everywhere. But it’s knowing the other things that are less common, but may be still relevant, that are useful. I think you get more from that, than from PBL, because PBL is just like a basic summary. (I1.76)

There is a complex understanding amongst these students regarding knowledge. They seem to accept that exams can assess knowledge, but they are not confident that this equates to an ability to practice at a high level. They believe that putting theory into practice requires additional effort not readily identified within the learning outcomes. They are not satisfied with passing exams at the minimum accepted standard. They are aiming above that level. Cilliers et al's (2012) research into the impact of summative assessment on student learning in a medical educational setting identified that assessments themselves can impact on the learning effort. They built on the work by Tang (1994) who identified two perceptions to assessment affecting the study preparation; quantitative and qualitative perceptions. A student who has a quantitative perception sees exams as testing the quantity of information and will approach learning with a low level of cognitive strategy such as rote learning, memorising and reproducing, with effort and time put into repeating studying in order to improve memory. A qualitative perception, however, sees exams as assessing understanding, integration and application of the content knowledge. Tang (1994) claims that these students believe that they have active control of the process and put effort into studying in a systematic and organised way. However, Tang (1994) also found a group of students who were not totally identifiable with either the quantitative or qualitative orientation as they perceived the exams to require a combination of both.

My study findings may offer further insight into this aspect. The exams may be successfully prepared for using a quantitative approach ("name me two possible causes for this patient's symptoms") but the students are intrinsically motivated to understand the content on which they are being tested. Memorising facts is not of practical use in preparing them to be a doctor. They need to understand the concepts. Having first understood the concepts, they will then memorise the facts necessary for the assessment. Marton and Säljö (1997) term this a transformative approach to learning. The effort that the students, now in their fourth year, put in is not because they are concerned about failing an exam, but rather because of the impact beyond the exam - they have long term clinical practice goals beyond the assessment. Cilliers et al (2012) conclude in their study that scheduling of

assessments, and strategically ensuring that they require more than surface learning strategies, can reinforce desirable learning behaviours. What is interesting here is that the students are identifying that the learning outcomes in PBL can be satisfied without deep level learning strategies.

4.4 Is PBL providing opportunities for students to build on their knowledge?

Hmelo-Silver (2004) advocates that PBL delivers medical knowledge in a cohesive way, integrating domains such as, for example, physiology, anatomy, ethics, law and sociology, into a clinically applied setting. Hmelo-Silver (2004) argues that this will allow knowledge to be fluently retrieved and applied under varying conditions. The rationale for this view comes from Barrows' (1986) belief that the learning, within PBL, is being embedded in context and focused upon useful clinical knowledge. There is evidence from this study that the curriculum as a whole is achieving integration of these domains, and that theory is being applied to a clinical context. However, it appears to take longer to achieve than the week that is allowed for within PBL, and secondary care placement is perceived as learning in context, rather than PBL.

Hania: You realise the importance of [the psychosocial topics] as you go through the years. That patient actually does care about whether you ask them about their ideas, concerns, and expectations. And they're not there for you to just garble science at them, because that's not relevant to them. So I have appreciated it more over the years, and that's why it's becoming an easier learning curve now. (I9.556)

Clive: It's when you are in an active environment, quite often on the wards. And if you are having a teaching ward round or something you will remember that, because it's being active. You've got a patient in front of you, so I mean it's real. It's not like "this is a case of Mrs X" but there is no picture and there is nothing to relate to. You can't see the clinical signs, you can't see the drug chart. So things don't tend to stick in that sense. (I3.174.2)

Researcher: How useful is secondary care?

Hilary: That is the most useful and the best part of medical school, because I am learning stuff, I guess, in the 8 weeks or 9 weeks we have on campus, but not a lot. But when I get to secondary care that's when I learn it. I always panic during the lecture weeks because I think “oh I’m not getting this, I don’t know what is going on”, and then I get to secondary care and everything just makes sense. And I always enjoy secondary care. It's a good experience. It's the best part of the course. So I look forward to that. Because that's where I learn it, just being around and observing things, or getting involved in things. (I7.485)

These last two extracts raise an important issue. Whilst PBL provides learning in context, these extracts identify that there can be a spectrum of weak through to strong contextualisation of knowledge. PBL, with its paper patient, is a poor substitution for the clinical placement already provided on medical courses.

Evensen and Hmelo-Silver (2000) commented that learning need not be in isolation, and research by Taylor (1987) indicated that, in fact, learners have a strong need to share new insights and test out understanding. In theory, PBL can offer a collaborative environment where learning can be undertaken. I sat in on four PBL sessions and made field notes throughout each session. My observations offer my perspective of a PBL session and this next extract demonstrates an example of a presentation a student is giving that engages the group and has an aim of testing and developing their knowledge whilst also offering the student presenter an opportunity to share her new knowledge.

Jennifer has a nice tone and her questioning is at an appropriate level and the group are interacting with her. She shows, on a PowerPoint slide, an image of a baby with a rash. Naomi says “he’s cute”, while Imogen says out loud a diagnosis, which proves correct. Jennifer offers more pictures and images of abnormalities and all are now getting involved. Jennifer is asking for diagnosis and causes, Isaac and Robert are answering, with Naomi saying “can’t pronounce it’ but also doesn’t try

either. Jennifer gives mature encouragement to any answers, even when they are not correct. She is demonstrating an ability to get her group to think with lead-ins such as: ‘would you want to investigate?' and 'is it normal?” She is able to give clinical reasoning behind answers given. She now asks another question to an image “what would you be thinking of in delayed passing of meconium?” Finn gave a weak answer, Naomi gave a good answer - both were not acknowledged by anyone. Jennifer's presentation is well sourced and had a good flow of information. Medical terminology was used to describe what was being visualised. Jennifer had references at the end of the PowerPoint presentation and a recommendation of looking at further ones on the web site. There were no questions raised at the end. (O2.276)

As a tutor myself, my field notes placed value judgments on students' questioning, such as 'weak' or 'good' answer. I note that the students were not being given this sort of feedback. There was very little elaboration other than offering factual knowledge and whilst it offered an opportunity for students to identify if they had gaps in that knowledge, it fell short. The student was a peer who had learnt her knowledge, and could present it in an engaging manner, but she couldn't 'tutor' on her topic. It was more common to observe learning moments that contained a mixture of correct and incorrect information, and whether this provided an opportunity to build on knowledge would be dependent on each student's ability to filter and organise knowledge during the discussion.

Christopher starts explaining normal labour. He remains seated and explains how he will focus on something he found that was new and interesting to him: the fore waters and hind waters. At the end, Ali asks him a question regarding whether labour is defined by contractions or by dilation of the cervix. Christopher answers him fairly well. Hannah adds about the different stages in labour: latent and active. Christopher elaborates that it is not as easy to define in clinical practice (which is true). The tutor asks “what advice would you give to a woman about when to contact labour ward?” A good link considering a woman cannot see their cervix dilation, but can feel contractions. Ali answers incorrectly about it being when the

waters break. Katie asks for clarity about effacement of the cervix. Christopher initially answers this query incorrectly, but then looks it up on his notes and informs the group correctly. Katie required further clarity, but Christopher is not able to elaborate beyond his notes. Bashir repeats the question that has yet not been answered “when do women get told to contact labour ward?” and Christopher now answers accurately, although incomplete, about the contractions strength and frequency being the key sign. (O3.311)

These discussions were of value, but a clear summary of the correct points would have aided a learner in this situation. There were also missed opportunities due to lack of preparation, or over ambitious presentations.

Anika is now presenting. She has quite a strong accent, and talks fast, so I need to concentrate to hear her, and to understand her. She starts with a clinical scenario, and then asks the group 'what do you want to know from the history?' Her presentation of the scenario had been a bit muddled and no one answers. She then asks 'What investigations do you want? Isobel and Hameeda are asking her to clarify what she is asking as the initial scenario didn't really channel them into thinking of a specific condition that needs medical attention. Anika is frequently referring and reading directly from her notes. I am not sure, from this presentation, what learning outcome is being contextualised. Attention of her peers seems to be lost and the tutor is occupying herself by reading the groups PBL written products. Anika is now being asked to speed up by Hameeda. It has in fact all gone a bit flat after this request and Anika immediately sat down although remained polite. Isobel looks uncomfortable and had a sympathetic face when catching Anika's eye. The tutor did not seem to be aware of what has just happened. There was no intervention from the tutor, nor from the group members. (O5.407)

These extracts raise the question of the pedagogical theory of PBL. My supervisor, on reading the above extract, queried whether PBL has a pedagogical theory or procedure, for instance whether there was some measure of agreement on when and how a tutor should intervene. This extract is an illustration of a learning

environment that is very much down to individuals. There are a number of views regarding the term 'pedagogy'. A general definition is that teaching is the central activity of education and is about conveying fresh knowledge, developing aptitudes and imparting skills, and 'education' is the shaping, development and improvement of someone's character. Quite often, pedagogy is associated with *what* should be taught and learnt (content aspect); *how* to teach and learn (aspects of transmitting and learning); and to what purpose or *intention* (the goals or aims of an aspect). Pedagogy is also associated with a means of control, such as control of classroom activity. Higher Education has introduced monitoring of classroom activity such as tutor peer review. Whilst there is a local peer review system among PBL tutors, it is difficult to see what is being reviewed. The tutor is not the key person supporting development - the writers of the learning outcomes are. Nor is PBL a traditional helping relationship. The identity and integrity of the PBL tutor is not part of the process of learning through PBL. However, there is a view of pedagogy whereby the 'educators' work 'with' the learner, rather than 'on' the learner. Nonetheless this role seems to lie more firmly with the PBL curriculum designers than the tutor in the classroom. The issue of non-expert tutors is raised elsewhere but it highlights a problem here as well, as it explicitly extricates the tutors as being involved in the deliberate process of drawing out learning.

This next extract illustrates how a poorly prepared presentation can form part of a PBL session without any criticism.

Andrew is now presenting and handing out an activity. He has cut and pasted paragraphs from a textbook and has blanked words out for the students to complete. However, the blanks appear to be chosen badly. The group are laughing in a good natured manner. Andrew is reading it out poorly and unable to elaborate. (O5.408)

These moments were never directly criticised by the group during the session, instead they were observed as being well tolerated. While there was evidence that

the feedback sessions can offer students an opportunity to learn, the brainstorm part was offering very little in terms of building knowledge.

The group are about to commence the brainstorm component of PBL - The length of the two scenarios for this week are considerably shorter than normal. There is a general jovial nature to the murmurings in the group about the short scenarios for this week's focus which is on breast disease. Clive says “I think these are awesome”. The tutor comments that they are short but a lot to explore so think "outside the box". Hannah, as Chair, starts by reading out the first case scenario and comments that Katie, who is not present, can catch up, "as the scenario is so short". Once Hannah has read out-loud the scenario, the first comment comes from Clive who just says ‘anatomy of the breast’. Bashir is scribe and writes this down. The tutor follows this comment up by asking “what do you think of the scenario?” in an attempt to get them to explore and discuss before going for learning outcomes. Someone answers "short". Hannah says “breast lump” the tutor immediately follows this up with asking "so how does it spread?” Ali contributes that it would determine treatment and the tutor prompts further to get the students to discuss ‘staging’. The tutor tries again “anything in that particular scenario?” Hannah answers “pathophysiology” and Christopher says “stick genetics in”. Clive starts to get a discussion going by introducing the concept that there are different types and Bashir, as scribe, is writing the words 'different types' onto the white board. Hannah wants it clarified that a learning objective that is identified as the word 'drugs' should concentrate on mechanisms of drugs, as this is more important than the name of the drugs used in breast disease. Daniel and Clive are not contributing and the group are sidestepping the tutor's valiant attempt to get them to explore the scenario and discuss. The group are focused on identifying learning objectives. (O3.328)

Of all the aspects to focus on in the 'case', the learning outcomes, surely, are amongst the least interesting. This situation of 'hunt the learning outcomes' has been documented in the literature (Bate and Taylor 2013, David et al 1999) and is a common concern within PBL locally. PBL aims to be a stimulating group learning

environment, but there is growing evidence that the PBL scenario is not the right trigger for a stimulating discussion amongst medical students. Yet there was evidence of interactive work being undertaken outside of the PBL group. A self-selected group was often expressed as being more satisfactory for learning than PBL, although it is possible that the experience of PBL introduces students to the skills and benefits of learning through group participation.

Jennifer: I'm working with people who are more intelligent than me. They're not going to be telling me things just for the sake of it, to act intelligent. What they're saying I know that it is truthful and that they would tell me if they are not sure.
Researcher: It's interesting that that's different to your PBL group.
Jennifer: Yeah.
Researcher: Why is there a difference?
Jennifer: I think because I have the choice of who I want to work with. Whereas the PBL group you're kind of just given a set of people who you've got to get along with and learn from. Whereas I haven't actually chosen them to be my work buddies and that kind of thing. (I2.141)

Jennifer trusts the people in her revision group. They would "tell her if they are not sure". The trust here is focused on her revision group, but the implication is that she has felt, within PBL, that some students have been acting the part of the educator. If someone identifies that there may be colleagues 'faking it' then it could lead to anxiety about trusting any of the group members. While it would appear that some dimensions of self-directed learning are enhanced by group learning, there needs to be trust, and this may require self-selection.

Gureckis and Markant (2012) say that the inclusion of self-directed learning, within a medical course curricula, is an accepted method as it can take into account the necessary frequent updating. PBL claims to promote a student's development of self-directed learning skills (Barrows 1984, 1985, 1986; Barrows and Tamblyn 1980; Norman and Schmidt 1992) through the practice of generating learning issues (Walton and Matthews 1989; Blumberg et al 1990, Davis 1999), within a small

group learning environment (Hammond and Collins 1991). This leads to self-study and its opportunities to develop and expand on learning strategies (Barrows 2000, David et al 1999) which go on to support lifelong learning, following graduation.

In order to build knowledge through self-directed study, the students need to manage their time well. David et al (1999) estimated that a minimum of 16 hours of independent study per week is required when studying medicine at undergraduate level. They didn't reference where they got this figure from, but the authors are from a UK medical school. My data suggest that students in my study are failing to achieve this level of independent study (Table 4). Perhaps the difference is explained by the lack of time allocated to independent study. Gijselaers and Schmidt (1992) were concerned about the impact on independent study when there was a packed MBBS timetabled programme of instructional and scheduled teaching time. But knowing what is a 'normal' range for independent study could offer some guidance for a student despite the fact that individuals are going to be resilient to different lengths of studying and different topics often requiring different lengths of concentration. Nathan (2006) collected data about her freshman year colleagues in America. Her participants were not studying medicine but nonetheless offers a start in considering how much learning at degree level in terms of a range in study hours. Her data explained that the students attended classes about four hours per day during the week. This figure is lower than the data collected in this study (Table 5). Students attending the NMS have a half day on a Wednesday, leaving three hours of timetabled activities, two days of the week there was seven to eight hours a day were spent attending classes, and on the remaining day, about five hours. Nathan (2006) reported an average of twelve and a quarter hours per week on independent study, with the variation from day to day being notable. Her sample, like mine, had some days where one hour or less went into independent studying and then four or more hours on one day within that week. Universities are increasingly wanting courses to identify 'effort hours' to offer students guidance in what amount of studying should be expected with a given academic credit number. Table 6 demonstrates Clive's study activity which was the least amount of total hours studied in the researched week and compares to

Jennifer's (Table 7) who had the highest total study hours within the researched week. The methodology within the study didn't collect the fine detail over a longer period of time that would be required to consider if Clive is demonstrating an ability to be more efficient in his studying than Jennifer, but given that they received similar exam results it is an interesting consideration.

Table 4 Independent Study Activity in the week they were a research participant.

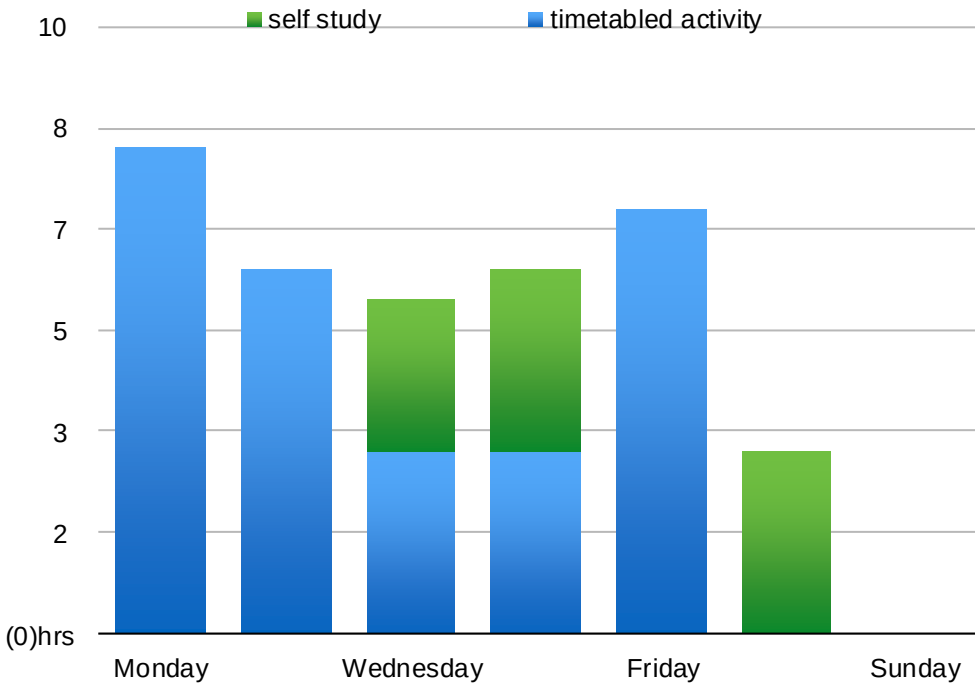
Self-study	0 - 5hrs	6 - 10hrs	11 - 15hrs	16 - 20hrs	21 - 25hrs	26 - 30hrs	**Total**
Clive							9.5hrs
Rebecca							11.5hrs
Anika							11.5hrs
Hazel							28hrs
Jennifer							28hrs

Table 5 Timetabled Study Activity in the week they were a research participant.

Timetabled	0 - 5hrs	6 - 10hrs	11 - 15hrs	16 - 20hrs	21 - 25hrs	26 - 30hrs	**Total**	**Grand total***
Clive							25hrs	34.5hrs
Rebecca							25hrs	36.5hrs
Anika							31hrs	43hrs
Hazel							28hrs	56hrs
Jennifer							22hrs	50hrs

*timetabled study time and independent study time combined.

Table 6 Clive's study activity



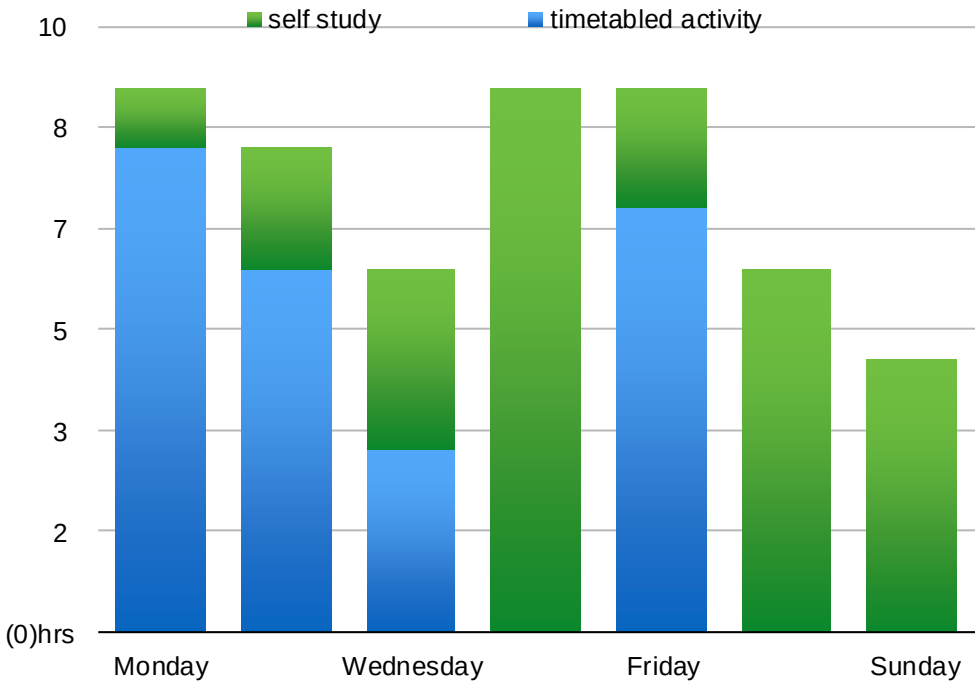


Table 7 Jennifer's study activity

The amount of time spent on independent study is an important factor, as students of this PBL course were often only associating knowledge acquisition during times of self-studying. However, this study suggests that independent study time is similar to data collected by Nathan (2006) but less than David et al (1999) calculated as being required. It goes some way towards explaining why students are expressing frustration at having to schedule independent study time on top of a very time demanding programme. Rebecca's point below raises an important issue of whether we are undermining autonomy in a learner, by controlling the learning environment to such an extent that we are hindering self-directed learning.

Rebecca: It would be nice to just have a bit more time to actually do my learning, because I do feel like I go to Uni for the whole day, and I don't learn very much. If I learn things it's sort of little points. And then I get home and then I have to actually learn stuff, but I'm too tired by then. After six hours of lectures you just want to go to bed. (I1.50)

Researcher Are you still happy on the course?
Clive: Yeah I am, I get frustrated, like I said, about having to come in for lectures. Quite a lot of the lecturers don't know how the course works, so you'll have the doctors that come in, who have been to a traditional medical school, and they expect you to know everything and they will pitch it at a far higher level than you know anything about. Some of them are just dire lecturers, and there are some I will write off, I won't go to on principle, because I know how bad they are. But in terms of the end goal I'm still very happy with where I'm heading. It's just that by having to come to lectures and then also do my own stuff on top of that, not that I wouldn't do my own stuff on top of that, because my own way of learning is so different to going to sit in on a lecture it makes it twice as hard, and I don't get as far as I would like to because I'm here all day.
Researcher: So would you prefer to do your writing and your own work during the day but you're not given that opportunity?
Clive: Yes (I3.155)

It is evident that, between the PBL sessions, self-directed learning is being undertaken, with students actively participating in learning medicine. PBL would claim to provide the necessary structure for this period through the learning objectives. David et al (1999) point to PBL's 'key feature' that "students decide what to study, not the teacher" (David et al 1999 p5). Such a claim lacks credibility as it is the faculty deciding on the learning objectives. Underlying the learning issues is a translation of the faculty objectives into a problem scenario. As Davis (1999) explains, they lead students to a topic or field of learning. This offers a confusing picture of the faculty influencing the learning outcomes and seems to imply a 'hidden agenda'. However, during independent learning the student has the freedom to decide what to focus attention on, and this is not necessarily the PBL learning objectives. The students were not requiring the reassurance that Hammond and Collins (1991) believe learning objectives offer. Nor is there a sense of what Kicken et al (2009) is suggesting when they say that the role of the PBL tutor is to limit the risk of students undertaking activities that do not contribute to learning. Nonetheless, some of the students found the learning objectives offered a structure.

Rebecca: I like the second rotation better because you have the learning outcomes. But yeah I do prefer to have them because I think you can, sort of, structure a bit better. But you have to guess in PBL, that's the whole point. It just seems like you're moving the goal posts the whole time. It's just difficult, "guess this". And then you spend an hour and a half arguing over what should go where, and how you should word the learning outcome, and it doesn't really make any difference. (I1.69)

Jennifer: With medicine, because they give you, well they give you the learning objectives at the end of each week but I don't know if I should be admitting this but I'm quite fortunate that I've got it from the older years, so I know what learning objectives are roughly going to be for each week and then I can do my notes. (I2.84)
Hazel: But I actually think that even though I don't read the PBLs the process of making learning outcomes gives me an idea of what I'm supposed to know that week. So in many ways it's useful. (I4.212.5)

So the students found the learning outcomes offered a structure but wanted access to them prior to the session. Kicken et al (2009) believe that the learning outcomes are there to offer a safety net if there is little, or incorrect, prior knowledge. They acknowledge that there would be a sense of negativity in such a situation and therefore the tutor, having access to some appropriate learning outcomes, will be able to counteract this as and when appropriate. However, this study found that the challenges of a lack of prior knowledge continued to evoke a sense of negativity when discussing a topic, and exploring how to go about learning it. The faculty-generated learning objectives were not shown to offer an adequate resource for the tutor, leaving the group with the perception of having to manage in the absence of a well versed facilitator.

Clive: I do like the idea of brainstorming the case scenario, I do like that. But trying to make questions on a topic that nobody knows anything about, I just don't understand. Because when you set that question you don't know, nobody has an idea what is involved in that, and I know it's the job of the PBL tutor, but often they don't, often they don't help at all. So you will end up with one person's question being a six or seven page PBL which then, everyone's like, you have only two pages to do it. And another person having psych-social outcome which you can do in half a page and you would feel that you had to string out into two pages. It doesn't work. If they wanted us to brainstorm the scenario and come up with the things, then give us the learning outcomes ...maybe. But to try and make these questions, doesn't work in my opinion. (I3.172.2)

The role of the non-expert PBL tutors, during a brainstorm of a clinical scenario, plays a crucial part in whether or not a student perceives PBL as a credible way to learn medicine. The fact that the learning outcomes are initially 'hidden' from the students indicates that the process of PBL cannot guarantee the case is fully unpacked. This situation can arise every week because there is no expert guidance in the classroom. Dolmans et al (2001) identify that the tutor has an important role in solving issues, but as the extract above identifies, they often cannot solve the knowledge based issues. Holmes and Kaufman (1994) say that the introduction of

non-expert tutors has been a modification of Barrows original PBL and that this came about because of the need to fill the quota of PBL tutors. Olson (1987) feels that the resulting difficulty in consistency in PBL tutoring is a problem which Miflin et al (2000) elaborated on by finding that such issues led to students becoming frustrated. Indeed, as the extract above shows, Jennifer used the word 'fortunate' to describe having access to the faculty learning outcomes.

The learning goals that the students have each week are central to what is actually studied, yet they do not have them in advance, at least not formally. A common understanding is that learning issues, whether generated by students or faculty, are used as guides for self-directed learning activities.

Researcher: Do you centre your learning of medicine, that week, on the theme of PBL or can it be something completely different?
Marion: Oh it's always around the week's theme. I don't have the imagination to do anything else. (I10.568)

However, this study found that the PBL learning objectives were not necessarily being used as a reference.

Researcher: OK. So this week, have you done anything that was relevant to the week that was set?
Anika: Umm no. (I5.231.1)

There seems to be a premise, with PBL, that, if students fail to generate appropriate issues that cover the intended learning outcomes, the expected curriculum content will not be fully covered. This study didn't find this to be the case and would support Dolmans and Schmidt's (1994) suggestion that the availability of global course learning objectives may be more in keeping with practice. Images taken by Jennifer (Appendix 18) illustrated one of the areas identified, that students were simplifying the generated learning issues into global subject areas to learn. The

purpose of the brainstorm could then shift away from identifying learning outcomes to a more collaborative learning and exploring of a new topic.

Barrows (2000) envisaged students seeking information to answer questions generated as learning issues, and that relevant information "literally seems to jump out of the pages or resources they are using" (p66). Barrows (2000) goes on to say "where their study has not resolved their questions, resource faculty are often surprised to find the problem-based learning students are more like graduate students in the quality, depth and detail of their questions. Conversations with them can be stimulating" (p66). There is no empirical evidence for this and the claim offers little guidance for students, or faculty, to develop appropriate learning strategies. This study's findings are similar to Dolmans et al's (1994), they found a discrepancy between the student-generated learning issues and topics covered during self-study and found that the learning issues do not prove to be the sole source on which students base self-study decisions.

Hazel: If I have a paediatrics text book I assume that I should know pretty much everything that's in it. I like to be quite logical about what I learn. So I don't like to learn all facts and think 'oh why does that happen?' So I quite like to read the whole book. Which is why my learning often isn't very week specific. For example I saw a patient with asthma in primary care and I never finished making the relevant notes by the end of the week as I spent quite a lot of time learning about asthma, even though its completely non relevant but because something has made me think "umm, I really need to learn that". So I'm not very week specific. (I4.194)

Learning resources were often reduced down to a single textbook, which is similar to assigned reading in teacher-directed learning.

Jennifer: It's word for word out of a text book (I2.93)

Jennifer's image also illustrated this aspect (Appendix 19).

Jennifer: At the moment, I'm trying to follow the learning objectives but I'm finding when I'm matching them up with the textbook, the textbook goes on and talks about other things which aren't necessarily on my learning objectives. So then sometimes I'm like "well I'll just quickly finish this chapter's notes". Whereas other times I may be like "OK, well I might be covering those again in the following week so I won't do them just yet". Like for example paediatrics ADHD, that hasn't come up in our lectures yet, or PBL, so I haven't made my notes on it yet but I've talked about Aspergers and autism, where it would kind of fit. I was just a bit lazy, I thought "I'll just see if that comes up a bit later". (I2.111)

Jennifer is guided as much by the importance given by a textbook as she is by the faculty learning objectives.

Jennifer: If it never comes up and I remember I haven't done anything on it, then I'll quickly do just a little bit on it. But obviously not as much detail as I probably would if it was on the learning objectives or a big section in a textbook. (I2.112)

Whether the use of textbook and 'textbook knowledge' is appropriate in learning medicine is an interesting issue. The gap between the first draft of a chapter and the book's publication is potentially years. It is not just the students who use textbooks. Faculty staff do as well, and often refer to the textbooks when writing exam questions. Textbooks are not good at keeping up with change. They may be superficial in some areas, do not contextualise the content and do not develop enquiry skills in preparation for lifelong learning. PBL aimed to move students away from textbook knowledge and develop their research skills by seeking more up to date resources. Nonetheless other resources often cannot offer the textbook organisation of knowledge which is presented in such a way that it can be gone over again and again. The knowledge is in one place, it is, often, thoughtfully geared to examinations, and, the book having been chosen by the individual student, is perceived as having credibility and trustworthiness, an aspect that is missing with peer teaching in PBL. Repeated encounters with a textbook offer the learner the opportunity to build on knowledge and understand more deeply. A recorded lecture

or student written lecture notes can't offer such consistent well-grounded knowledge foundation. At undergraduate level there is, within topics, some stable knowledge. The physiology for instance is not necessarily changing continuously, but the management of a medical condition could be. A system based curriculum that integrates clinical placement with theoretical knowledge offers students the necessary opportunities to learn a topic in a holistic way, over a period of time. The students focus on textbook within their campus based learning, but move to alternative resources when they are ward based. David et al (1999) suggest that students will rely on textbooks and not seek alternative resources because they feel there are too many learning issues being identified, and their concern is that this results in a surface approach to learning. Whilst it may be that the number of learning issues generated leads to a need for an economic and efficient learning strategy, it doesn't necessarily follow that they are not engaging thoroughly. However, students identified that they needed to adapt their learning from the PBL way, as this would not allow them time to sufficiently cover material across the curriculum to a level that was believed by them to be appropriate.

Anika: Like week 2 was so condensed with information, basically congenital abnormalities across all systems. If you genuinely learnt it all, I don't know who can, but actually properly learnt all the topics in that one week, it is completely unrealistic. So I rather spread them out. (I5.234)

Hazel: I find <pause> OK <pause> I find doing PBL useful because it's a really good way for me to learn a topic and I think if I actually did it for every single learning outcome in the week I would get a lot out of it. But I would have to spend so much time working if I did that because, I've got down *[looking at activity sheet]* that I spent five hours on one piece of PBL so I would be having to fit in fifty hours to cover the learning outcomes for a week and it's not really feasible. But I always find that the topic that I have done, I learn a lot. (I4.212.2)

Shahabudin (1987) calculated that topics, identified from problem scenarios, if covered as lecture-hours, would exceed any lecture based timetable. To put it in perspective they calculated that it would require a further 22 weeks more than the

time available (Shahabudin 1987). David et al (1999) believes that because of the excessive workload, students will revert to coping directly from a book, a study behaviour that was identified within this study.

Clive: I know people who do, that have the learning outcomes from the year above, and they will go through every one, and make notes on every one.
Researcher: But that doesn't work for you?
Clive: It's a lot of stuff to do. Whereas if you've got your core text book (singing the praises of Kumar and Clark here) but you've got it all there. (I3.171)

Clive: Kumar and Clark is the bible as far as I'm concerned. It's a shame it doesn't have an obs and gynae section but for the whole of year three that was my text book. And if I needed to supplement it I would look on the internet. Because everything you need to know is in that book and if you write it out you can't fail to know what you need to know. The text book is pretty key. (I3.148)

Megan: I generally go with what's in the Oxford Handbook. If it's in the Oxford Handbook then that's what we need. And if I find it interesting we probably don't need it! (I11.635)

Ismail: If I read a textbook, I'd read it three times by the end of the module. So I would read it once, read it again, read it again. Because I find every time you learn something. Obviously the first time you learn it, it's new to you, so you're picking up the concepts, words, the structure, how it fits together. The second time you then start to integrate the patterns that they are trying to show you, and then the third time I think it seems to come together and amalgamate in a logical construct in my brain. I find three times is what I need to learn something. (I8.521)

PBL claims to offer an alternative to assigned reading in teacher directed learning (Barrows 2000), yet there is little evidence that this is happening. Olson's (1987) investigation had similar results to the present study whereby within his sample of 30 medical students, half of them reported approaching PBL by spending most of

the time generally reading. Within the discipline of medicine, textbooks contain the type of material needed at undergraduate level and the explanations are clear. Self-directed learning within undergraduate medicine can include human resources such as peers, specialists and personal experience as much as the internet, journals and textbooks. However, as Berkson (1993) identifies, the dominance of textbook use as a resource is likely to be due to the fact that the written textbook and the exams are engaging in the same content. Barrows (2000) didn't believe that textbooks would be the most appropriate resource and said that "textbook, at best, can only give an overview. It would be far more valuable for students to review original articles, online information resources, anatomical dissections, models, microscopic slides, resources faculty..." (p63). However, Skinner et al (2004) consider learning as an independent activity where the learner needs to build knowledge for themselves, and therefore learning from a textbook is a suitable and straightforward way. There is a sense that the learning habits readily adopted by the students are not fitting the design of PBL. Miflin et al (2000) wonders if this is why some students are becoming frustrated with the PBL process.

The present study's curriculum offers opportunities for students to use other resources and clinical placement was frequently cited as being influential in learning medicine.

Hilary - I tend to ask a lot of questions when I don't understand things, like when I was on Obs and Gynae I went into the antenatal clinic with at least ten questions because I was like "I don't understand this" and people are really open to answering them. So I am more, my learning is more of an interactive style. So I really like secondary care. (I7.486)

Hazel: I especially try, when I'm on placement, to see as many patients, try to present back every patient that I have seen to someone, ask questions about things I really don't understand, print out patients' blood results and try to work out how it applies. Because I know that that is all the kind of stuff that we get tested on. And it's not just stand alone. It ties in with all the stuff we have been learning about. For

me it's a practical way of doing it and preparing me for, not just the exam, though obviously for the exam, but if you can't do it now you won't be able to do it later on. (I4.208.2)

PBL originated when medical students studied in University for three years and did not attend clinical placement until after this period. In this instance the problem scenario aimed to offer a bridge between the theory and the practice. Contemporary medical education integrates clinical and theoretical right from first year. With a system based curriculum the students are offered different learning opportunities and resources while studying and the clinical placement provides context to the theory. PBL offers a means to allow flexibility and adapt to change in knowledge, but the way knowledge is now being provided has itself changed leaving PBL itself as a process that is lagging behind the times.

4.5 Summary

Within medicine, knowledge is a vital commodity, not only to pass exams and ensure successful graduation, but throughout the career of an effective doctor. Gormley's (2011) review on undergraduate medical training found that assessments were providing a powerful influence on learning. This study supported Gormley's (2011) view in that the participants have not only studied at a level that has demonstrably achieved results, but have aimed to learn more than the core curriculum knowledge. By achieving more than the necessary requirement, they gain marks over those of their colleagues who have not. This is a worthwhile investment because exam results over the period of the whole programme have a significant influence on their choices in post graduate training.

Learning in context is valued within contemporary higher education although Ellaway et al (2014) note that there are relatively few studies that have explored the beneficial effects of delivering a program in real-world conditions. In this study the student participants attributed learning in context to their clinical placements, and not to PBL. In fact, learning moments were rarely being triggered by the problem scenario and the students were distracted by the task of finding the week's learning outcomes. There was also a sense that the non-expert tutor was unable to enhance group interaction, resulting in the group learning environment not being able to compete with students' self-chosen revision groups. Batchelder et al (2010) reported that the number of medical students increased from 3594 in 1996 to 6314 10 years later, but by contrast there has been a gradual decline in clinical lecturers in the UK. Batchelder et al (2010) explain that it is this that has led to an exploration of alternative methods of delivering the curriculum, including that of medical students delivering teaching to their peers. The non-expert tutor being present in the PBL session seems to have the aim of offering a balance between independent learning and governance. Burgess et al's (2014) systematic review found that there were self-perceived benefits in peer-led teaching, such as development in the understanding of knowledge content and students' perceived preparedness for assessments. However, Knobe et al (2010) found that staff members were still rated more highly than student teachers, and Burgess et al (2014) didn't find any evidence to conclude that peer teaching improves examination performance. So the student teacher may feel a benefit not shared by the fellow students receiving the knowledge.

PBL in itself does not provide knowledge, and this appears to put it at risk of being a method of learning with which students choose not to engage. The self-directed component of PBL was valued, but, significantly, was not attributed to PBL. Self-directed learning was also undermined by the lack of time given to it within the timetable. The lack of independent study being timetabled into a campus week, and PBL being supported by lectures, offers a confusing picture about when, and how, a student should learn the knowledge required for medicine. Nonetheless, this study found students capable and willing to commit to learning, and at times, to study

beyond the core curriculum. Knowledge, during campus weeks, was generated from textbooks. PBL claims to offer the opportunity to develop alternative sources of information, but these were only being accessed by the students when on clinical placement. Cilliers et al's (2012) study equally found their medical students demonstrated a limited use of resources. They also attributed this to a high workload, inhibiting the sourcing and utilisation of material other than that provided by lecturers. The most powerful influence of PBL and its weekly learning outcomes may be that it explicitly encourages students to study every week, as some aspect of the learning will be observed, by the group, during the feedback session. Yet students who have chosen not to follow the PBL agenda were still fully engaging in learning and developing their knowledge base.

Chapter 5

Learning efficiency

5.1 Introduction

The second major theme to emerge from the data was the students' objective to learn with maximum efficiency.

Rebecca: Ideally I'll like to study as little as possible, and know as much as possible. (I1.65.2)

The previous theme identified that for all of medicine there lies an economy of knowledge. Successive data analysis cycles identified that a lot of the initial data supporting this theme, was, in fact, a distinctly separate theme. If knowledge is a commodity then it follows that doctors who learn more will survive better. At an undergraduate level, prior to qualifying, not only is survival a key focus, but also knowledge is vital in laying foundations for competitive success within the profession. Therefore, it follows that having an ability or skill in learning efficiently is desirable. For medical students who aim higher than just passing, it is an essential process. Lundvall and Johnson (1994) popularised the phrase 'economics of learning' as a subheading to economics of knowledge (Drucker 1969). Getting the most educational value out of the time available requires a learning process that combines speed and retention in order to lead to knowledge recall and transfer. Knowledge can be appropriated by anyone capable of using it, so a crucial factor for success involves the choices that students make regarding their learning. In other words, a learner who studies for longer periods of time should theoretically have more knowledge.

Marion: I work so fast, quite commonly. I know I shouldn't say that. But the PBL topic can be so unpredictable about how long it will take you to do, that it undermines your ability to plan the week. This is another issue, this is, that you can get a PBL topic that can take you an hour and a half, or you can get one but will take

you six hours, and you can see that that is going to completely knacker any way of structuring your week normally. (I10.592)

Marion is identifying the problem that the learning outcomes around which the week's learning is structured do not take into account the time frame available. She is aware that learning takes time. The data within this theme found that time management was a conscious active process amongst the students. Commitments outside studying were stripped to the bare essentials and a key process was the decision regarding what should be studied in the time available. When this autonomy was impinged upon, students expressed concern.

5.2 What makes for efficient learning?

Students were evaluating their learning process - both self-study, and timetabled activities such as PBL sessions and lectures - based on its efficiency. Some students identified the frequency of learning moments covered within a certain time, or within a mode of delivery, as a quantitive gauge on whether that learning was considered efficient.

Marion: I just think this year the information-to-time ratio is so low. So I am a bit frustrated and I didn't go [to the lectures] yesterday. (I10.569)

Clive: It's [PBL] probably a more pleasurable three hours and, as a result of that, I probably do pick up more stuff. Because it's more interactive, I might listen to more stuff, but, again, it's not worth three hours of my day. (I3.172.1)

Jennifer: When someone tells me something, I can't pick it up as easily as when I read it from my own notes. So I feel as though, if I didn't go to the seminars, I could spend time doing this. In the extra time I could. I'd much rather just go home and, well, just stay at home, and use the seminar times to make my own notes, and I think that'll be a lot more beneficial for me. (I2.123)

Ismail: It [going to the lectures] doesn't help me. I went to all of first years and I just found I was more annoyed at the end of the day than anything else. Because it would be a lot of sitting around. And you would probably only get twenty minutes, or maybe ten minutes, of the lecture that was actually worth maybe something that you didn't understand, that was quicker for them to explain than you going and spending a couple of hours to figure it out yourself. So I didn't find it very efficient. I seem to be able to get two hours of work at home, the same amount of volume, that I would get from spending six to seven hours at Uni. So after first year I didn't really attend very much after that. (I8.505)

Marion: Generally, I go to lectures and most of the time I feel I'm not using my time efficiently.
Researcher: So they are not useful?
Marion: I'm not saying that. I'm saying I know I can work more efficiently. (I10.563)

The students are confident in making these judgements on learning moments and how efficient they are. They are 'A' grade students and have experienced what was required in the lead up to being successful when demonstrating knowledge in an exam situation. I feel this is not too dissimilar to the approach that elite athletes take, the medical students are not saying that their training has poor techniques which will lead to an educational equivalent of an injury, but that they perceive an alternative training method would provide optimum strength, power and speed over that of the training that is being provided.

5.3 Strategies for efficient learning

Efficient learning requires the learner to appraise information. Mcloughlin (2009) believes that information management is paramount to the learning process. He reports that some students are better than others at determining the relative 'weight' of units of information through an ability to differentiate central concepts and key principles from marginal details. Mcloughlin (2009) believes that efficiency

in storage of meaningful information is the primary restriction to one's later ability to retrieve it, and that efficient information-organisation requires a personally relevant strategy. The student participants in this study were top of their cohort, and the data support some of Mcloughlin's (2009) views. For instance, a number of students demonstrated that organisation of knowledge was recognised as an important feature for retention and recall.

Ismail: It's not quantum physics, or something that pushes your mind, it's just a lot of information that we've got to put in a nice way for our brain and just find the best way to do that. (I8.522)

Photographic data also supports that the students are organised. Anika's image (see Appendix 20) shows a handwritten timetabled curriculum activity sheet on the wall, she has added external commitments and exercises. Next to this she has her folders of notes labelled and in easy reach. Rebecca's Image (Appendix 20) also offers a sense of organisation.

Medical textbooks were frequently cited as being a key resource within the learning process. Students talked about how the information within the textbook was credible and trustworthy and contained all the necessary information. They were a quick and reliable resource. No time was wasted searching for the necessary information. In addition to this, a number of students referred directly to the organisation of the textbook being of benefit. A few students chose to follow the textbook structure rather than the timetabled structure, and their reason for this was to be as efficient in the learning process as possible.

Clive: I tend to, because I think by this stage I know what UEA wants or what the medical school wants, so I do pick and choose what I make my notes on. And when I make my notes I don't do them, probably ridiculous really, but I don't do them in the order of the weeks that we are doing at Uni. I will get my book for that module and I will go through that book. Because I think that book is put together in a particular way to make it flow and that's why I will stick with whatever is there. So

quite often I don’t know anything about the [focus of the] week we’re probably doing. (I3.144)

Clive's aim was to complete his notes during the campus weeks ready for placement. This strategy can be considered very efficient as it offers a flow, starting with him focusing during the campus weeks on knowledge (knowing that), and applying the knowledge on placement (knowing how). At OSCE, he will need to demonstrate that he knows it (shows how), and is thus ready for graduation (does). All of the students referred to their need to make decisions on what to study and what to leave out. At times, students based their decision on whether learning that covered a wide scope outweighed learning that covered a few subjects in depth, and other times, the opposite was adopted. Some students talked about how much was timetabled and how they were needing to 'run' to stay on top of things, and this was cited as the reason why they had no time to go into depth. There was a recognition that studying medicine can be overwhelming in terms of how much potential knowledge there is. One goal was to be successful in the next exam. The exam structure was a key factor in students' decision making. Identifying core knowledge was important. The ability to identify and learn the core curriculum gave students confidence prior to the exam. Confidence in the core curriculum allowed students to ensure that the basics were covered, and covered well. This was a strategy to secure maximum points. Without this ability to prioritise, there was a concern about being overwhelmed.

Researcher: So at the moment you have chosen not to concentrate on them? You have mentioned about the fact that there is an overwhelming amount of stuff, so you have strategically ignored certain aspects?
Clive: Yeah.
Researcher: Presumably because you don’t need them for the exams?
Clive: Yes! Which is naughty, I will admit that. But when you have to put in hours and hours of work to remember a list of facts to have one MCQ with five answers, the, sounds geeky, but the cost benefit ratio is just none existent. There is just no point doing that whatsoever. There is no incentive to. (I3.165)

In traditional teaching, the tutor offers guidance on a topic's depth and importance. However, in a student-centred environment, there is minimal guidance. This requires students to make choices about what they are going to learn and what they are not going to concentrate on. Not only is the correct decision-making required to be successful, but this lack of guidance affects how economical their self-study is. No tutor has identified, on the students' behalf, the areas and aspects on which to focus. The better a student is at quickly identifying and prioritising appropriate core curricula, the more efficient their learning. In order to overcome the lack of guidance from tutors within a PBL curriculum, students seek support and guidance elsewhere. The textbooks were a key resource for this purpose, but also guidance from peers outside of the PBL environment.

At the end of her presentation, the Chair, Finn, thanked Imogen. Finn said he found it a difficult subject and that it had taken him some time to get his head round it. Isaac asked Imogen's opinion on what she thought they would "need to know". This led to a short discussion between Isaac and Imogen on assessment questions. They concluded that there may be a link with a clinical abnormality. The tutor didn't get involved and there was no expectation that he should offer an opinion. (O2.271)

Anika: Then I have one friend who has graduated who, for the last year, she's an FY1 now, she was really good and just telling you what is important. Because I think that's the benefit of having senior friends. They tell you what is important and you have a mentor. (I5.238)

Researcher: Have you changed the way you learn over the past four years?
Hilary: Yes I think so. I used to be very much a self-learner, just by myself. But now, since I've started to do medicine, and as the years have gone on, I have done more group work. Like group study sessions, and revision sessions with groups, which I had never done previously. I have only been doing it the past two years. And I found that has helped me massively. I can condense more information in a shorter period of time than if I was just doing it on my own. So yes, that is the technique that I have added, definitely. (I7.495)

In order to assist efficiency, students have bridged the gap in guidance from a tutor by finding a mentor.

5.4 Barriers to learning efficiently.

Being efficient is about speed, but also about being effective in the time you have. Barriers to learning are identified and avoided where possible. For instance, learning alongside another students is only perceived to be strengthened if that other student is considered to be intellectually on the same, or higher level.

Anika: It sounds really bad but I am very selective of who I can work with, because being only moderately productive feels like a waste of my time. (I5.240)

Another barrier to learning can be the structure offered to the students. Students demonstrate a clear sense of personal autonomy over what to learn, how to go about learning, and when a good time to study is. When this is constrained, the students express frustration. A number of students described a self-directed learning process that was independent from the process of learning through PBL.

Hilary: Sometimes I literally don't like the structure of how they have laid out the weeks, so I'll do it by systems, or whatever. So I'm completely out of sync with the weeks, but it's been an easier way for me to learn it. (I7.499)

The word 'frustration' was used by several students, which seemed to refer to a feeling that they were being prevented from progressing, succeeding or being fulfilled. Sometimes they felt frustrated by a lack of an efficient mode of delivery of knowledge, and other times by barriers to self-study.

Clive: I come to them [*lectures*], because we have to come to them. And I know a lot of people who don't come to them despite the fact that we have to come to them (but at the point you receive your Bradford score come to your final application); I don't see how you can miss them. And I find that incredibly frustrating because I come here and I sit for three hours, four hours, of my day, and my attention span is

pretty limited, I would say, when it comes to the lectures, maybe ten minutes, fifteen if it's a good lecturer? But after that I'm in my own little world, and unfortunately I can't bring a book and do my own notes while I'm there because I can't concentrate with someone talking in the background. So no, they are a massive inconvenience, but I do go. And I suppose you do pick up, when you've got clinicians doing the lectures, you do pick up clinically relevant things that have happened in their practice. And sometimes when you come to writing in your note book it will trigger a memory. So the question, I guess, is whether the time you put in is worth that one kind of "Oh yeah I remember someone mentioning that". And I would hazard a guess the answer is 'No' because if I had the extra hours I would probably make my notes out of Kumar and Clark, and then supplement them with Davidson's or something, but I don't have the time to do both. (I3.152)

Marion: I would love more time to study. I like studying. I like private study. I came on this course because I thought I was going to get to study. I thought "PBL? Great. We are going to be encouraged to do lots of the work ourselves", and there just isn't time. That's really frustrating. (I10.575)

Time management is a key component of learning efficiency. Students were keen to spend time studying, but spend it on their self-directed activities.

Marion: It's difficult when there just isn't enough time. When you're scheduled for what three, four full days a week, it doesn't help. Especially when you get days like primary care at the moment; ten hours is not good use of time for what turns into three hours teaching, for which I could have read in an hour and a half. (I10.596)

These students are motivated to learn, but there is a sense that the design of a curriculum can run the risk of being unacceptably controlling of a student's time. In PBL, the learning required, as chosen by faculty, is placed within the context of a patient or scenario. Rather than presenting subject information that would allow a linear, serial relationship of ideas and information - a term of processing Mcloughlin (2009) describes as successive processing - PBL selects information into a group or

network of various subjects. This manipulation of information presents how knowledge will need to be recalled in a multidimensional manner. The suggestion is that PBL will encourage students to process information from a number of ideas simultaneously. Simultaneous processing is considered by Mcloughlin (2009) to be superior to successive processing. He believes that it requires the learner to thoroughly comprehend the information; rather than approach it as a series of unrelated facts susceptible to being learned using rote memory. However, this is not so straightforward an idea, given that an ability to read and write require simultaneous processing skills. Students identify that a PBL problem will require segments of reading, which then need to be considered in relationship to the whole, so requiring an ability to 'jump' from a central idea of one topic to another main or subordinate topic. However, students describe a learning process where they have converted the separate subject areas back into broad topic areas to learn, and then approach learning these topics in a more linear manner, rather than "doing it backwards" (I8.511).

Rebecca: I think, if you read the text book, then you kind of get the more intricate things of how it links in with other stuff, and why things happen. And you get PBLs where it's a list of: this happens, then this happens. I find it really hard to just learn lists, it doesn't have any relevance. Whereas in a book, it's in context with everything else. And, if you're doing it in a book, it gives you time to look up things you don't understand, and add it into your own notes. Whereas [in PBL] other people have changed it so that it makes sense to them. So it's, kind of, like using someone else's revision notes the whole time. (I1.20)

This is such a curious observation. PBL is intended to help contextualise knowledge; but Rebecca says that the text books do this better. Text books have improved, probably under the same influence as classroom teaching, in that research in medical education emphasises learning in context. However, what constitutes the 'context' is not a fixed phenomenon. PBL integrates a number of topics and a number of disciplines and aims to put them, as a whole, into context. Textbooks

often put basic science learning and a medical condition together in order for the condition to be understood as a whole. It is the integration of physiology and pathology that Rebecca finds supportive in her learning. Ismail also describes the need to first gain some foundational understanding before it is placed into context.

Ismail: The one thing I do before each module is that I'll learn the physiology first. And then that, kind of, puts me in good stead for the rest of the module. So that is one bit of structure that I give myself.
Researcher: And that's at the beginning of the module?
Ismail: That's at the beginning of any module. So I'll learn as much of the physiology as I think I'll need to know, and then everything seems to follow from there really. (I8.508)
Ismail: I'll then learn the structure that <the university> put into place in terms of what they want us to learn and then I'll do the drugs or the anatomy, anything like that. But starting with the physiology gives you a good base and then everything seems to follow from there. (I8.509)
Ismail: I think if you understand the basics of what's going on. It just gets you to there and then you understand the rest of it at the end, the clinical cases or the symptoms and the signs. But if you've got the groundwork then everything seems to be a lot easier. Rather than do it backwards. (I8.511)

Within the PBL process, having presented the relationship of topics as a whole, it then requires the students to separate them into individual learning objectives. At times, this even led to stand alone topics being divided up. Jennifer illustrates this issue in the following extract:

Researcher: For this week, what was your learning outcome?
Jennifer: Factors leading to normal growth excluding diet and endocrine. And look at any national guidelines. (I2.100.2)

There are a number of ways a subject expert tutor would go about designing a teaching session that synthesises the information required in order to fit with the time spent in front of the class. The PBL students do not have an overall picture of a

subject that would allow them to achieve this and consequently will, at times, split connecting subject detail. The reason behind this is to achieve a manageable group activity, rather than for pedagogical reasons.

5.5 How efficient is PBL?

If efficient learning is important and necessary amongst medical students, then it is important to consider the efficiency of a PBL approach.

Marion: I really hate PBL sessions.
Researcher: Because?
Marion: Because it's not efficient use of our time. If I had taken fourteen hours a week that we have talked about I could learn so much in that time, I could do three hours' work a day, and I would have it covered and I can play the piano and do my singing practice and go to the gym and do the other things that I used to like to do and I can't. We are chivvied from place to place. And there is this constant pull with the university; academically they want us to be adult learners but there's no time when we are treated like adults. 75% of my year are graduates, and lots of them have got masters degrees, or further degrees, yet so many bits of the way the course is structured just undermines your ability to teach yourself to learn. And yet we applied as if it was a teach-yourself course. PBL absolutely epitomises this, this tedious round of wittering on (sorry). It just doesn't suit the way I learn. I think that is what it comes down to. If it suits the way you learn, then fine. (I10.598)

Anika: So I find it easier and more productive towards the end of the module to go over PBLs and lectures and everything, and integrate everything much quicker than being forced to learn it every week. (I5.222.2)

Students adapted learning through PBL, from what it is designed to be, to what suited them. The overall ethos of the curriculum design was difficult for the students to interpret. On the one hand they were given learning objectives to go away and learn through self-directed learning yet with little independent study

time, and yet on the other hand they were given didactic teaching by subject experts on the set learning objectives. A hybrid curriculum is combining two opposing pedagogies. Without a consistent and coherent understanding of the curriculum's pedagogy the students will either choose one over the other or devise their own approach. It was PBL's pedagogy that was the least understood by the students.

Hazel: I do my PBL the way I want to do it, the way I'll remember it, the way I get the most out of it. (I4.189)

The students frequently identified the first year on the PBL curriculum as a time where their expectations of how to study 'the PBL way' did not give them confidence in their knowledge. Students explained the study strategies they had adopted by year 2, given the need to study for longer and in more depth as the years went on. These strategies were commonly independent from PBL and the reason for this was around efficiency.

Jennifer: I really got into a panic about how there was too much to know in too little time. And I did really get myself all worked up in that exam period. And so then at the start of second year, when I thankfully passed first year, I was "right something's got to change" and so that's when I started doing all my handwritten notes. And I used people's PBL more in second year umm I don't know why. I think I got into a lot more depth in third and fourth year, than I did in second year. Again, don't know why, just something I've developed. But I think it was after making the notes I realised that actually I find it more useful making my own notes than sitting reading people's PBL. (I2.107)

Hazel: But I don't read other people's PBLs because, I tried in the first year and first year was the year I did the worse because I think I was trying to learn in the way that I thought I should learn. So I thought I should read everybody's PBL every week, and I should go to lectures and I'll get all that I need, and that's just not true. I didn't feel very confident in my knowledge at all, and (I think this is the part of me being

slightly a bit of a perfectionist) I often feel that if I read a PBL I would have to go and read it in a text book anyway, because I don't think, (it's not anything insulting against other people's work) it's just the way that my brain works. It's other people's words, I'd still have to transcribe it, I would still have to try to learn it in my own way. And so I just found that the time that I saved not reading them I could use in a way which was more productive for me. (I4.212.3)

Students perceive members of the PBL group as key to the success of the PBL session. However, their focus is on how the session runs, rather than collaborative learning. Students were not incorporating fellow members of the PBL group, or the PBL session, as part of their learning process. The learning process amongst the students interviewed was reliant only on themselves and their ability to direct their own learning between PBL sessions. Most of the students referred to the small group session when asked about PBL. A specific area on which the students commented was of the group developing learning outcomes during the brainstorming.

Clive: My PBL group this year is ten times better than any PBL group I've had up to now. It's a very clever group. It's very effective and economical in the way it works. Because the process of PBL is so group-orientated, if your group doesn't work, PBL does not work, it's as simple as that. If you haven't got a group where people get along, that's not the most important thing, but where people don't respect other people's ideas, opinions, it just doesn't work. I've had groups in the past, where coming up with the learning objectives will take an hour and a half, and you saw when you came to our PBL group, it took about half an hour, which is a relatively long time for us. (I3.170.4)

Isobel: We try and get the learning outcomes from the scenario, which is sometimes easy and sometimes hard. And for some reason this year, I'm in a group where we seem to find it quite hard work to nail them, I don't know why. I was talking to our tutor about why. There is a mixture of quite strong personalities and people who

give every impression of not caring less, and it can be quite difficult, I think - dragging. I think it's often the same people who do it and that can be a bit frustrating. (I6.444)

Marion: The worst thing about my PBL group is that you have to fight over the learning outcomes. This group wants to bicker about learning outcomes, debate them to death. It's like "just give us them". It's just a vacuous, pointless noise that goes on around it. It drives me scatty. (I10.599)

The student are finding the brainstorm to be inefficient, and these perspectives are supported by my own observations.

Isobel, Aiesha, Peter and Michael are all talking at the same time about what content would be required to cover a specific learning objective, and whether they can find the information in a textbook. A lack of underpinning knowledge seems to be making the writing and composing of learning objectives a complex procedure. The tutor is not assisting in this discussion (she is not a clinician). Isobel says, to the group, that she remains unclear about another learning objective, and there is another long discussion on how to cover 'main developmental milestones and normal physiology'. Not knowing what systems are involved is proving difficult for them. Without this knowledge they are finding it hard to identify a clear, manageable and relevant learning objective. (O5.392)

They have completed the brainstorm in forty minutes. Ten minutes of this was spent identifying learning issues from the scenario. The other thirty minutes was sorting out wording for each objective and discussing how much is to be covered in one objective. (O4.355)

When brainstorming, the time is mainly spent on organisational, housekeeping discussions rather than discussions on prior knowledge. This gives the brainstorming the sense of being an unproductive learning activity. Students were

more accepting of the feedback component of PBL. However, this was also perceived as inefficient which contributed to students having negative perceptions of PBL.

Researcher: Do you learn anything from the feedback aspect of PBL?
Marion: I like quizzes. You do learn, but it's not efficient. With this course you're kind of tense all the time because the work's not getting done, and then, once you've done it, there is no time to relax, because there is a whole load of other faff coming in. So yes, I find that frustrating. (I10.600)

5.6 Summary

It was clear that the students wanted to separate their frustrations with PBL from their choice to study medicine.

Marion: I'm not unhappy.
Researcher: So you enjoy learning medicine?
Marion: Yes, I love the subject. And that's one of the reasons why I work hard and revise. When I'm left to my own devices I just get on with it. (I10.601)

Wormald et al (2009) found a significant link between the weighting of a subject and the learning behaviour of medical students, with the drive to study a subject directly influenced by its importance within the overall scheme of assessment. The student who negotiates effective learning will have an improved chance of being successful in exams, and if the exams represent what knowledge doctors require, then exam success should also offer a prediction of success as a doctor. PBL has often emphasised its ability to encourage students to adopt a deep approach to learning. However, the economics of scope (variety) frequently outweighed those of scale (depth) for the undergraduate students.

Students are not identifying PBL as having the necessary frequency of learning moments associated with efficient learning. Multidisciplinary strands of topic

knowledge, placed within the context of a patient, are being converted by students into stand-alone topics, ready for an efficient process of learning. The PBL problem overtly offers a top-down approach to introducing information by offering an insight into various compositional systems. There is no additional breakdown within each learning outcome. The role of the brainstorming is to identify the subsystems of the learning outcomes that requires detailed learning. So the learning process outside of PBL is approached with the traditional bottom-up design, whereby individual subsystems are learnt in detail. It is as if the PBL approach takes a scenic route rather than the fastest route to get to the same destination. A medical textbook approaches the teaching of a topic using a bottom-up approach.

Cognitive theorists emphasise the importance of knowledge being organised in order to assist in learning and recall. Organisation of information can take time, and cognitivist recommend that teaching offers guidance in this in order to support efficient and effective learning. Within PBL, learning outcomes are divided up amongst the group. The exclusion criteria in Jennifer's learning for the week (I2.100.2), whereby she focused on learning the factors that influence growth in childhood but was directed to ignore diet and endocrine, places external factors on her organisation of learning outside that of the topic itself or her method of learning. Good organisation can also refer to having realistic expectations of what can be learnt. Within a PBL curriculum, this organisation is done for the students through learning outcomes set per week. Where these prove unmanageable, then the credibility of the PBL process is undermined.

The support and guidance that is traditionally offered by a tutor is absent in PBL. Kirschner et al (2006) in their critique of PBL and its premise of constructivism, whereby students need to be taught how to construct by being presented with minimal information, point out that there is no evidence that partial information enhances the ability to construct a representation, when compared with offering full information. Indeed they believe that partial information is less effective and less efficient, while complete information results in a more accurate representation that is more easily acquired.

The implementation of PBL locally does not appear to have fully translated constructivism's approach to learning. The result is that students in this study, perceived that learning through PBL was inefficient and not intuitive, and use exams to guide where their efforts should be placed. While PBL encourages self-directed learning, students were making a conscious adjustment to their learning in order to address the perceived limitations of PBL. The students focused on arranging for their learning to be reliable, and structured in a systematic way. The main method that offered this structure was learning medicine straight from a text book. Their self-directed learning were therefore perceived, by them, as being independent to PBL.

Chapter 6

PBL and the conflicts that can arise

6.1 Introduction

The previous theme identified that students were able to explain a personal relevance to the study strategies that they adopted. During the fieldwork, I was interested in the relationship the participants had with the learning process, and in exploring their views on what they did in order to learn, and which aspects of the process they valued. My purpose was to explore whether PBL was influencing their approach to studying. A theme that emerged at an early stage of the research was what I will call a PR issue between the student and PBL.

Marion: And that's one of the biggest issues with PBL; 'what am I here for?' (I10.606)

Rather than students describing a study identity that had evolved through engaging with a PBL environment - a study identity that was a state of becoming - they associated themselves with a study identity that was an accumulation of their past, especially their approach to A level study. This identity of themselves as scholars didn't appear to have shifted within the new context of PBL, yet, importantly, it is a person's study identity that assists with a response to a learning environment.

6.2 PBL and its conflict with a student's study identity

The students described a feeling of conflict towards the PBL system, and this led to them discriminating between aspects of the curriculum they accepted and those they rejected. There was a sense that they viewed themselves as maverick, learning 'off piste'. Resistance to change in study habits is not what advocates of PBL envisaged, yet this finding is not surprising given that medical school takes only the 'best' students, which will be those students who developed a system of studying

that proved demonstrably successful in enabling them to meet the high academic entry requirements, and who demonstrated suitability at interview. Not only do students see no need to adopt the PBL approach but also they were excluded in the design of this approach to learning and so have little reason to be excited by this innovation. However they are unlikely to form a counter group as they have yet to be accepted into the profession. The result is that the planned curriculum differs from the learnt curriculum. The students are setting their own curriculum in order to manage the conflict.

Exploring a student's study identity seemed key to examining more deeply what was influencing a student's approach to studying. All students are individual and will approach learning in their own way, nonetheless, with nuances aside, there are a number of common overarching themes that allowed the participant's study identity to be explored. A key component was the personal value a student placed on a specific topic, but even when a topic was considered of value, there arose tensions if the student didn't value its delivery method. Commonly, lectures were regarded as so variable that students gave them a low value as they were not consistently providing opportunities to learn well. The compulsory timetable can enforce student attendance, but, it seems, cannot enforce engagement.

Clive: I can see when you are in school maybe you don't understand yourself enough to know how to best learn. But when you've reached your twenties, you know what works for you, and being forced to do something else is counterproductive. It's not good for anyone. (I3.177.2)

The resulting value associated with a topic or method of learning influenced the level of engagement in the activity of learning, and whether the intellectual endeavour was worthwhile. Students were also attaching value to knowledge and skills relevant to their personal future plans and goals, with a fear of failing adding a cost value.

The students entered into medicine with the expectation that learning medicine and becoming a good doctor would require considerable individual effort and so an industrious attitude was apparent. They also demonstrated an attitude of preparedness, both in terms of being a doctor and also for assessments, thereby avoiding and mitigating any negative outcomes. Management of emotions highlighted that exam results, which are often considered by faculty to be a permanent internal statement about the student's ability, were perceived, by the students themselves, to be a temporary external factor which could be controlled and changed, by studying harder or in a different way, thereby improving exam results. The students also demonstrated how the use of constructive self-talk was helping them to manage their emotions, behaviour and self-control. The end of module OSCE seemed to offer a good motivator. Patient care also offered an incentive to 'get it right' and it seemed that the 'job' at the end was a main driving force in maintaining motivation throughout the five year course.

Students explained their study behaviour in terms of strategies and tactics which were themselves influenced by self-regulation and belief. They demonstrated an ability to self-direct their learning, and whilst some were influenced by PBL, this wasn't a consistent finding. The common resource valued by all the participants was a combination of a good textbook and a notebook. The making of notes was used to facilitate the learning process at the time. Secondary care placement also offered a valued resource as clinicians offered direct one-to-one teaching. Patients were also mentioned as a resource, but were not spontaneously mentioned as often as text books.

Overall, these students, who were the top of their cohort, offered a sense of internal locus of control, self-restraint, orderliness and direction. Self-regulation seems to have been heavily influenced for a number of them by a difficult revision period prior to their end of first year medical school examinations.

There was global acceptance of the relevance of acquiring the knowledge contained within each learning outcome. However, the method of delivery generated

emotions, attitudes, values and beliefs which influenced the students' choice as to whether or not to learn in that environment. Their discriminating factor was the learning environment, and this in turn affected their subsequent behaviour and motivation. There was no consistency amongst the participants about which environment supported learning, but each participant had a conflict with one or more of the environments. The overarching theme from the study identity for each participant was that of a discriminate student, self-regulating and self-directing their own learning, and, at times, this was being hindered, rather than supported, by the curriculum.

An extract to illustrate a student study identity, and the quality and meaning of its overarching theme of the discriminate self-learner, is taken from Hazel's interview.

Researcher: So how do you approach PBL?
Hazel: <pause> With difficulty. I like the PBL experience but more because I think it intrigues me, I find people quite interesting and I find that the variety of PBL groups that I have been in over the four years quite interesting but I don't find ...<pause> (I4.212.1)

The term "difficult" is used by a few students when discussing PBL. Rebecca (I1.69), Hazel (I4.212.1), and Anika (I5.222.1) use the term to refer to PBL facilitating a way of learning that is not in tune with their individual study identity. Hazel, in this extract, appears to be referring to feeling confused by PBL. She starts to break this down into components. She sandwiches the negative within positive comments. She initially talks about the session itself. PBL is considered by Hazel as an 'experience' but not, it seems, for learning. She is hesitant in finding words to express how she approaches PBL.

Hazel: I find <pause> OK <pause> I find doing PBL useful because it's a really good way for me to learn a topic and I think if I actually did it for every single learning outcome in the week I would get a lot out of it. But I would have to spend so much time working if I did that because, I've got down [looking at activity sheet] that I spent five hours on one piece of PBL so I would be having to fit in fifty hours to

cover the learning outcomes for a week and it's not really feasible. But I always find that the topic that I have done, I learn a lot. (I4.212.2)

She then talks about the written product that she produces for her peers, and how that one topic is useful to her learning. During the interview she had explained how she believes that her PBL work may be used by some of the group as a primary source of learning and therefore ensures her work is of a high standard. So she fully engages with a single PBL topic. This is in line with the literature on how PBL has been observed as supporting a deep approach to learning. Hazel appears motivated because of the responsibility of it being a collaborative exercise. However, Hazel's interpretation is that she should be making this effort for all topics. Although she considers herself to be responsible in supporting others to learn, she is not relying on this effort being reciprocated. She goes on to explain why this is.

Hazel: But I don't read other people's PBLs because, I tried in the first year and first year was the year I did the worst because I think I was trying to learn in the way that I thought I should learn. So I thought I should read everybody's PBL every week, and I should go to lectures and I'll get all that I need, and that's just not true. I didn't feel very confident in my knowledge at all, and (I think this is the part of me being slightly a bit of a perfectionist) I often feel that if I read a PBL I would have to go and read it in a text book anyway, because I don't think, (it's not anything insulting against other people's work) it's just the way that my brain works. It's other people's words, I'd still have to transcribe it, I would still have to try to learn it in my own way. And so I just found that the time that I saved not reading them I could use in a way which was more productive for me. (I4.212.3)

Hazel is explaining that the preparation of a topic for 'teaching' others results in very thorough learning, but reading or talking about other people's learning is not the same thing. Her colleagues are not experts and so it seems reasonable that she would not trust them to have got everything right. However, because of the organisational culture, she has explained this mistrust as an issue within herself, her perfectionism, rather than attributing it to a limitation of PBL. She talks about "other people's words" with her peers' work having already been adapted and

learnt, and the synthesised end product is something Hazel needs to do for herself. She has identified with and is engaging in the key aspects of PBL that are likely to produce the best learning. The word 'productive' was a term used by most of the participants at some stage in their interview. The students used the strategy of discriminating in what they learnt in order to be both efficient and productive. There is a limit on time, but almost no limit to what can be learnt within medicine, so making good decisions, and prioritising, is important.

After her first year, Hazel stopped approaching PBL in the way she believed PBL should be approached and modified it - engaging within the session, and producing work on one of the week's learning outcomes. The remaining time, she engaged in self-study. She does not mention learning knowledge associated with PBL. To an observer, Hazel would appear fully engaged in the process, accepting the culture of PBL, but backstage she is doing self-study.

Hazel: So I essentially produce a piece of work every week and turn up to PBL because I have to. But I don't turn up to PBL and not want to be there. I know a lot of people really don't like PBL, think it's a waste of time, and I think that comes across when they are in the PBL room and it's just really unproductive. Part of it is about working in a team, working with people that you are not, that you might find difficult to work with, and I think that I find that quite useful. I quite like chairing and I quite like scribing. Sometimes, because I don't read the PBLs, yet we will be bickering over the wording of a learning outcome, I just think "this is actually really stupid because I don't read it anyway! I don't know why I'm getting so into it". (I4.212.4)

The students' perception of a threat to their learning needs, interests and concerns led to a feeling of conflict and discrimination in favour of certain learning methods. A conflict is more than a mere disagreement. It is a situation in which people perceive a threat to their well-being. Learning medicine is meaningful to the students, both for exams but also for preparing them for their future responsibilities. They know the 'job' they will be doing, and the information,

management and critical decision-making that will be expected of them, as they observe it every time they go on placement.

Anika: Well sometimes I find PBL difficult because it forces you to do certain topics at a certain time. I like to be kind of free and decide which topic I am currently interested in. (I5.222.1)

After graduation, students may perceive the conflict to be over, and that they now have autonomy over their own studying.

6.3 Cultural conflict with PBL

During the interviews, a pattern emerged whereby students were aware of how they were expected to learn within PBL but were quietly studying in a way that was independent and individualistic.

Clive: I'm onto the obstetrics section now, so as you can see it has no relevance to what we've done at Uni [the weeks theme was Breast Cancer].
Researcher But that doesn't bother you?
Clive: Nope (I3.151)

'Cultural fit' was a theme identified early on in the fieldwork. In fact it emerged when I was interviewing my first student participant, Rebecca. I originally thought of this as 'disquietude' - a mixture of anxiety and feelings of unease. The word has an emotional value which I associated with Rebecca and her feelings towards PBL. However, disquietude wasn't only being expressed towards PBL, but the whole curriculum. Rebecca came across as wanting to study medicine but the timetabled curriculum was creating obstacles rather than supporting her. The participants were clearly mindful that the culture of the PBL curriculum was setting the tone, defining what the students should do, with the implication that in doing so they would thrive. However, they were describing how they had found, with experience, that it wasn't effective for them, that, for them, the curriculum design was an encumbrance to studying medicine. These students were the top of their cohort,

yet the key behaviours of these students seem to be at odds with the 'organisational' culture. Saldana (2013) believes that culture is an ongoing performance, an unfolding production, and, in qualitative research, can be used to explicate organisational rituals and understand relatively private performances. I had narratives identifying that the students were not choosing to fit into the 'culture' of PBL, yet had been silent on this matter. Cultural fit is also about maintaining the status quo.

Researcher: You don't question it? You've not asked your colleagues?
Jennifer: No I haven't, no. I know I spoke to one of them, and I know he struggles to get through all the PBLs because he's one of the resident tutors so he's got a lot of other work he's got to be doing. So he doesn't find time to always read peoples PBLs. I haven't spoken to anyone else (sounding surprised) really about it. (I2.117)

The word 'acculturation' means 'the result of assimilation, through continuous contact with another culture'. There was no evidence of acculturation of PBL amongst the student participants. They were taking responsibility for committed learning, but they did not perceive this to be fostered by PBL.
Clive: I think it could be improved dramatically. The interaction is good, the whole idea of your working in a team, that's what you are going to be doing for the rest of your life, is very good, if you take it that way. But for actually learning, in terms of learning outcomes such as academic exams, it doesn't work in its current format I don't think, for me. And I think that reflects the opinions of most people, who see coming into PBL as a chore. (I3.179)

The students have not yet been accepted into the community of doctors, which is their ultimate aim. Therefore the tutors on the course and the course director could be perceived as border controls - it is safer to be seen to accept the culture rather than rebel. This would explain why the students are not complaining about the timetable and how it is hindering their studying. They described the timetable as being 'packed' which gives a sense that there are a lot of teaching activities compressed into a short timeframe. Yet this term can also indicate that individual learning activities are possibly being flattened because students are going from one

activity to the next without any time to think about what they have just learnt. Students are already performing to an audience, that being the community of doctors and peers, and they will become part of this community when they qualify. Even back stage where there are no tutors, they often do not drop the performance.

Rebecca: I think it's kind of polite isn't it? So people say "oh did you see this in my PBL?" It's not fair if you have done all that work and no one looks at it. So I do, I do look at it. But it's not a huge thing. (I2.23)

They want to be seen as 'fitting in' to the cultural norm. Therefore to not be able to find the PBL way of studying helpful is something that they have to manage themselves.

Marion: I appreciate you doing the study actually, because I think the medical school does have different aims for us, and the University does. And there is also a lot of box ticking as well, like compulsory lectures, I don't really think there is evidence that it's the ideal way to teach. (I10.607)

The students and the instructional design of the curriculum have the same goal but the students are reaching it in a different way. The data suggest strong conflicts, not so much with competing goals, but with conflicting beliefs about how best to learn medicine.

6.4 Conflict with the Curriculum

The curriculum design can appear to place a value on activity according to the hours that are dedicated to it. If the value placed by the students on that activity is low then there can be a conflict. If the student is undertaking an activity and spending time on it, but with little learning evident to them, then they will be critical of the curriculum.

Rebecca: You don't really have the freedom to do your own learning here. I think it's kind of like 'learn our way or don't learn'. If you take a book into a lecture, I've been in trouble for that, I just think well I was doing my own work, I was sitting quietly, I wasn't disturbing anyone, and you make me come in for my lectures but you can't force me to learn from a lecture. (I1.53)

De Grave et al (1996) considers conflict as an axiom of PBL whereby cognitive conflict within students is required in order to lead to conceptual change. They go on to say that PBL assists with this conceptual change as there are elements within it that promote dissatisfaction with the existing state of knowledge, thereby leading to knowledge activation, elaboration, and discussion with other students, all of this being preparatory work. The promotion of explaining and elaboration, and the defending of one position to peers, leads to social conflict and is an essential trigger for knowledge change. The authors are arguing that conflict is an advantage to knowledge change, but there was little data to support this at undergraduate level. The knowledge was predominantly new and simply had to be learnt.

The school's Annual Evaluation Survey tries to capture information on the MBBS programme by asking students to rate their satisfaction with each element of the course, using five point scales. Fieldwork on the present study was carried out in the academic year of 2012-13 with all student participants in their fourth year. It seemed relevant to the data collection to add this cohorts' annual student's evaluation. The annual evaluation of 2011-12 with specific reference to the feedback from the then year three's, and the annual evaluation for 2012-13 but this time looking at the year four feedback, would both relate to the student participants' cohort. The data was collected by Survey Monkey and analysed every year by a Research Associate in Medical Education within the Faculty.

In 2012, only 53% of students in Year Three indicated that they were 'very satisfied' with their learning experience in PBL. This was in contrast with the cohort in the year above, where 71% were 'very satisfied'. However Year Two and Year Five were not reassuring figures either with only 48%, and 47% respectively saying they were 'very satisfied'. With only half the students in three cohorts stating that they were

very satisfied is worrying for a curriculum that heavily relies on PBL to support students learning medicine. In the following year's survey the participants cohort continued to only express 56% rating their learning experience in PBL as 'very satisfied'.

The open ended responses were similar to the more detailed answers given by the student participants within this study. The Survey wasn't adding anything new to the emerging synthesis. Some examples are below:

"Researching the topic has been useful, as it has allowed me to learn one area in good detail each week" ID 7 Mod 10 2012-13

"It is hard to have a non-clinical tutor by Y4. There is no one to challenge our work or tell us what actually happens in a clinical situation as distinct from what we might read in the textbook. Our tutor has been very pleasant but I personally have felt pressured to rely on the knowledge of my previous role rather than being able to concentrate on increasing my understanding of clinical issues." ID 12 Mod 9 2012-13

"The concept of PBL is great but in actual fact it adds very little to the learning process" ID 14 Mod 9 2012-13

One student noted, in their reflection on PBL, that it has more of a place in the early years. This was Barrows original intention, that PBL be used for the first two years at medical school and for students to then move on to independent study.

"I think by year 4 the PBL process hits a plateau in terms of its usefulness. PBL has been very useful in previous modules when we still had not completed general medicine and when our study and interpersonal skills were still developing. But by now, we will have gained the skills of brainstorming, working in a group, researching and presenting topics, etc. This time it very much felt like the novelty of the process that worn out and most of us would have rather gone away and done our own work

to learn the learning outcomes rather than do PBL. I personally feel doing my PBL each week is the barrier to my desire to just sit down and start doing my own study, which by year four I believe is more efficient than going through the motions each week into which we have been hypnotised. Furthermore, I think we have been so used to tackling PBL by systems that it is very difficult to do this with paediatrics which can't really be approached like that. So in that sense PBL became an unnecessary headache. ID 7 Mod 10 2012-13

This student describes the process of PBL as initially 'novel' but then explains how he or she wishes to return to their own method of studying. The continued need to attend PBL for the duration of the MBBS programme has become such a conflict for this student that they describe it as an 'unnecessary headache'.

6.5 Summary

The students' individual values, beliefs, attitudes, emotions and motivation all influence their behaviour within a learning environment. Their individual choice of resources and the ability to self-direct themselves influence their ability to learn, and their time management and self-regulation skills influence the quality and quantity of learning. All of these factors combine to create an individual's study identity. It is this presence of a personal study identity that I suggest is associated as the stimulus behind any conflict with the design of a curriculum. The result is that students have to make strategies on how to minimise any disruption to their learning.

Learning appears to be influenced more by a student's study identity than the design of a programme's curriculum. This study found that the mapped learning that a student undertook over a given week, was frequently not in parallel with the timetable. The PBL based timetable is seen as a representation of the culture within which the School wished the students to learn, but was not a reflection of the students' own choice of learning method. Students appear hesitant in raising issues

and concerns because of a worry that, if they did, it might be misinterpreted as an inability to learn deeply, or as an indicator that they are 'problem' students.

PBL aims to be student-centred, yet there is little data that support this notion. Students are in reality often learning outside the formal curriculum, and choosing not to fully embrace the PBL culture. PBL claims that it is better for all learners, ignoring the fact that some students may not suit the characteristics and demands of this method. It aims to provide a positive learning environment, but there are no guarantees, and PBL, rather than recognising student learning, may just be another way of controlling the learning environment. By laying down learning tasks and activities, the faculty is potentially limiting the time students can study. Group learning also cannot guarantee benefits for every member of the group. There is no clear hero and villain here, as all conflicts are contextual and each side has its own story, but it is important to recognise that the learners themselves need to believe there is a value to PBL before they come to accept it.

Students on an MBBS programme are highly intelligent and, by Year Four, are experts in understanding the curriculum as it unfolds. Their critical appraisal should be of value and inform a course review. Students have arrived at medical school with well established, successful study habits and methods of learning for passing exams. In order to be successful on the MBBS programme, the immediate goal continues to be to pass the examinations. PBL is not geared to preparing students for examinations and so it is understandable that they refer back to their A level study habits rather than adopt a new approach to learning.

Chapter 7

Discussion and conclusion

7.1 Discussion

PBL is a tool for learning and revolves around a constructivist approach whereby an individual's knowledge can be enhanced through elaboration and cooperation within a learning community. The original aim, made by those who devised PBL, was to provide an alternative, more satisfying method of learning to the heavy didactic knowledge acquisition of the traditional lecture approach. Yet the themes in this study have identified tensions that exist with students' perception of PBL.

This study set out to explore how students go about studying medicine within a PBL curriculum. The research questions explored how students interpret PBL and how much influence PBL has on their study habits, and aimed to acquire greater detail of PBL in practice from a student's perspective. Understanding the PBL experience from the students' point of view is a necessary condition for supporting their learning. In this study, the participants were critical, self-determining medical students with an intrinsic motivation to learn medicine. There was also evidence of an underlying anxiety regarding the reaching of their goal to be a doctor, both in relation to their journey towards graduation, as they were reliant upon the assessment and consequential judgements of others, but also in relation to the reality of being a doctor.

This chapter explores the study's findings and aims to place the students' relationship with PBL into context. In practice, the design of the PBL curriculum and the students' goals were at times collaborative, whilst at other times contradictory. The tension experienced by the students appeared considerable and their emotional response was to not fully engage with PBL. This thesis reaches a conclusion that whilst it is understandable for students to focus on their own individual development, the curriculum design needs to ensure that there is a

mutual balance between developing a self-reflective autonomous learner and developing a medical student's ability to participate in a socially responsible way. Some reflections on how this can be taken forward locally are proposed, and future research identified.

7.2 Collaborations and contradictions

PBL suggests that group learning, and teaching peers, can offer all students (irrespective of their personal study identities) a suitable learning environment. This belief sets the tone for the culture of PBL.

Student participants conveyed a strong sense of being productive and efficient self-learners. Learning medicine was meaningful to the students and no student criticised the content within the learning outcomes. The relevance of the topics to the learner is an aspect that PBL claims to promote through providing a close relationship between the authentic patient focused scenario and the learning outcomes.

This study established that students were identifying with one of the constructivist assumptions noted by Loyens et al (2007) in that they were self-regulating, and had a sense of responsibility towards knowledge acquisition, autonomy and empowerment. However, they did not attribute such development to the influence of PBL.

PBL provides an opportunity where students meet up as a group, and engage in a collaborative approach to learning medicine. However, students lacked a clear understanding of PBL as identified by educational constructivists, and opportunities to develop their knowledge constructions were not being fully realised. For instance, during observation, very little data demonstrated encouragement towards the elaboration of knowledge and purposeful discussion arising from the 'problems'. Additionally, little feedback was being offered to students on whether their constructions were complete and accurate. Rather than identifying the

feedback as an opportunity to elaborate, rehearse and share ideas, students regarded it simply as a tool for honing their skill of presentations.

Within the literature, the engagement observed in PBL was often used as evidence that students were acquiring knowledge. Whilst there was evidence of engagement throughout the duration of the PBL session, analysis has identified that students perceived only sporadic learning moments.

Although the 'problem' is a defining component of PBL, the majority of students linked the problem scenario only to a game of 'guess the learning outcomes'. They all recognised that learning medicine is complex and while the learning outcomes helped support the structure of the learning, the generation of the outcomes was of little relevance to the subsequent process of learning. Observations of PBL sessions found that the brainstorming exercise concluded when enough learning outcomes had been found, and any further dialogue or interaction with the scenario was rare. The feedback aspect of the PBL session was commonly organised as a number of short didactic teaching sessions. Any potential learning moments were often diluted because of a lack of preparation or overambitious presentations.

The PBL learning outcomes were being perceived by students as being in place of a teacher. Students are novice untrained teachers, and with only a week to learn the subject, are unlikely to be able to elaborate when required. This perception has also been identified, and criticized, within the literature on PBL.

Overall, the students' collective experience was that there was a focus on acquiring knowledge but that this was not being facilitated by an expert, thus leaving the individual students feeling that they were required to generate learning moments for themselves without being given the opportunity to develop the skills to achieve this.

There is evidence that in their first year, they explored studying through PBL, but this was self-directed and their experience led to anxiety and a lack of confidence.

Consequently, they returned to the study strategies used in 'A' levels, which they looked on positively as those methods of study had led to them successfully gaining entry into medical school.

This study found that the top students developed an efficiency in their learning. The students that I interviewed were clear that they were at medical school to learn, but a number of the students made it clear that they perceived lectures and PBL to have both played only a minor role in their knowledge acquisition. Learning medicine through self-study, on the contrary, was reported to be the most valuable method. They regarded both effort and good planning as being key to success. They believed that, if they managed and controlled their time well, they would achieve high examination grades. Subsequent challenges with time management within a demanding course, where learning outcomes required unpredictable levels of effort, resulted in tension. Students were frustrated that the timetable schedules were limiting self-study time and, therefore, limiting knowledge acquisition.

7.3 Student conflict with PBL

The perception of studying medicine has historically been one in which a student doctor independently studies for long hours. The primary role of PBL, from the students' perspective, is to integrate specialist knowledge. But they are not clear where this knowledge is coming from – is it from textbooks or from experts giving lectures? Is it from their peers within their PBL group, and if so, where did those peers acquire their knowledge?

The student participants within this study might have been particularly anxious about preparing for their assessments because of past experiences. A number of the participants had needed to make adjustments to their studying in order to reach the necessary grades to get into medical school.

The challenges of teaching adult students also included tensions they expressed with the hybrid curriculum design and compulsory attendance. The students were as critical of lectures as they were of PBL. Compulsory attendance constrained

learners' autonomy which was leading to frustration. The opposing pedagogies of PBL and lectures can give the impression of a lack of trust in one or the other, offering a picture of the two methods competing with rather than complementing each other. This conflict was identified by a number of students who had chosen to study at NMS because of it having a PBL curriculum.

7.4 Taking a wider perspective on PBL within medical education

Part of the task of data analysis is to provide an understanding of how ways of thinking and of conceptualising the world become normalised. Hall et al (2008) claim that typically people regulate their own behaviour and actions in accordance with idealised representations that are institutionalised in specific contexts. Yet the findings in this study had a low congruence with expectations, with students having a strong but distorted sense of what was required from PBL.

During the educational reform of the 1990s, PBL was seen as offering a means by which medical students could acquire lifelong learning skills to assist in the ever changing face of medicine. It has become increasingly important for students to acquire both the 'hard' and 'soft' knowledge that is necessary to practice medicine. Medical education has historically dealt with 'hard' knowledge – a solid bed of facts with 'evidence based medicine' considered the gold standard. However, even with regard to 'hard' knowledge, we are no longer doing our job if we do not prepare students for the reality of rapidly changing knowledge within medicine. Present-day doctors need to be able to access knowledge, on their own, from various sources. Many practical problems in medicine require 'soft' knowledge, because of the complexity of the real world and dealing with individual people who are the patients. Most of medicine can be examined from different viewpoints and a doctor needs to appreciate this. PBL is flexible and is well suited to the dynamic context of medical education. Its sessions have the potential to include both the participant and the acquisition metaphor and the PBL method is a way that can ensure learning is relevant, both to the student's own personal needs and also in meeting the course objectives. PBL can provide the environment for co-operative learning

thereby, influencing student learners to develop as individuals who have empathy, who can reflect, and who can be socially aware. It can offer a means to develop the ability, through good communication skills, to come to well-reasoned management plans and encourage a holistic/integrative approach to medicine.

During the dissemination of PBL within medical education, literature exploring the step-by-step process of PBL has been evident, but the literature on its theoretical underpinnings is marginal. Neither my PBL staff training nor the students' introduction to PBL at the NMS included exploration of the constructivism perspective of knowledge acquisition. With tutors and students left to find their own pedagogical interpretation, it is not surprising that it becomes framed around a more traditional pedagogy relating to the acquisition of knowledge. Most academic staff are likely to come from a more traditional educational background and may therefore not be able to immediately understand how their role in a PBL setting will be different, and how their approach to PBL can impact on the students' own understanding of PBL.

Students did appreciate that the element of participation is necessary for a PBL session to go smoothly. Sfard (1998) differentiates learning with the use of two metaphors - 'acquisition' and 'participation'. She defined the metaphor of acquisition as a personal possession, focusing on the individual learner. Participation, on the other hand, is about 'knowing' rather than 'knowledge' and requires the learner to be actively engaged with learning in context. Sfard (1998) believes that the two metaphors relate to two different visions of the mechanism of learning. For Sfard (1998) the design of PBL is focused on the participation metaphor, with very little attention being paid to the metaphor of acquisition. Sfard's (1998) critique seems in line with the less favourable view of PBL held by the participants in this study. Students voiced satisfaction with learning during their clinical placement where they noted that this is where 'it all comes together', so they did appreciate participation, but on campus, they believed that a focus on participation was to the cost of knowledge acquisition.

In the context of the student participants, their goals towards learning medicine were being manipulated by the course developers' determined objectives, which commonly focused on 'hard' factual knowledge. Supporting this view is the fact that knowledge based assessments are the crucial component of success in undergraduate medical education. The degree of success at each assessment influences long-term career benefits. Rather than students being influenced by collaborative learning to enhance knowledge acquisition, the cohort ranking that exists in undergraduate medicine infers that an individual process is more appropriate. The consequence of this is that students were making decisions regarding the extent to which they would engage with PBL in order to ensure a favorable PBL report from their tutor, without it having an adverse effect on their chances of being successful at medical school. They were well aware that two failed attempts, at any one exam, would lead to an automatic withdrawal from the course. In addition to this, the PBL report, written by the tutor, can be an additional drive for individuals to aim to reach a grade of 'outstanding', as opposed to being part of a co-operative group member.

In the 1990s, there was a clear recommendation from the GMC to focus undergraduate medical education on a manageable core curriculum. However, there is continued evidence that students feel overwhelmed by the amount they need to learn. This is leading them to prioritise, with their first goal being to pass the exams. It may be that a PBL curriculum has effectively moved the burden and responsibility of information management control from the course designers and tutors directly onto the students. It may be that this burden of responsibility, undertaken in isolation, is the reason students focus their energy on acquisition aspects, but their frustrations with such an experience have been clearly identified.

The study's findings are in line with Cebeci et al's (2013), whereby students adopted a more strategic approach to learning, and Cilliers et al's (2012) findings whereby assessment is the main determinant of learning and study strategies. In the context of assessment, there were no tangible rewards for the NMS students to adopt PBL because it was not geared to preparing students for examination, leading students

to stick to the method of learning they used for their 'A' levels. This is in line with Reid et al's (2012) study which found that medical students' approach to learning showed little significant change during the whole of the medical degree programme. They considered the possibility that the students' approaches to learning and studying may have been consolidated before they reached university age.

7.5 Implications arising from this study

To simplify PBL into a prescriptive process, one that emphasises participation over enhancing knowledge acquisition, appears to lead to vague notions of learning through PBL and its potential value to not be realised. Yet, twenty years on from the first introduction of PBL in UK medical schools, students are graduating with the necessary knowledge, skills and attitudes. Indeed, a 2014 GMC survey of graduates' views placed the NMS, where this study was set, in the top position for preparing students for their role as a doctor.

Educational design should not rely on inaccurate or idealised versions of what students are, and what PBL is, or is not. With the successful implementation of early clinical exposure and integration of disciplines within a system based curriculum design, it has become difficult to study the influence the present PBL process has on learning medicine. Nonetheless, I believe it has an important place as a co-curricular experience, with a PBL session complementing regular curricular activity along with clinical placement and lectures.

The ambiguity regarding the purpose of PBL can be addressed within medical schools. Whilst the literature review identified that there is no consensus on PBL, there is no reason for this situation to exist within individual medical schools. Working towards the development of a clear ethos underpinning PBL within a medical school could initiate a dialogue between staff and students that would bridge the gap this study has identified between theory and practice.

These findings also have implications for PBL tutor development at a school level. Not all facilitators will have an awareness of students' perceptions on PBL, nor their values regarding learning medicine. I propose that it would be helpful for facilitators and course designers to note and reflect upon details within this study that identifies the aspects most valued by students.

7.6 Limitations of the study

It is important to note several limitations regarding this study. This was a small-scale investigation that focused on the experiences of 'A' grade students studying medicine. The focus on students from the top decile aimed to reduce some of the variables between a successful approach to learning and PBL's influence. However, it may have led to exploring a cohort of students where PBL is considered self-defeating as they are so focused on gaining good grades in exams. Assessment proved to be a significant distraction for the study participants, but it is not known if this would be a universal finding within the student cohort.

Although I have demonstrated that the students' perception of learning medicine is influenced by their assumptions relating to what it is to be a doctor, and consequently what learning can prepare them for the reality, it was not possible to see if, on graduation, such assumptions had needed to be altered. This information would be valuable in assessing whether the conflict that students experienced regarding PBL arose from a distorted sense of what is required when learning medicine. It would be interesting to investigate these student participants again, now that they have all succeeded in becoming practising doctors. How would they feel about their views now? Do they have a fuller understanding of the integrative pedagogy that PBL offers?

This study only focused on students' perceptions of PBL, without considering the viewpoints of the facilitators or course designers. Further studies to examine the other stakeholders' perspectives (other than my own) would have allowed consideration of whether there was agreement with the direction in which this

study was leading. In particular, triangulating data on facilitators' perceptions of their role, and their training in preparing to be a PBL tutor, could have provided useful analysis on the impact this would have had on the students' perceptions.

Following analysis of the themes, narratives were required to be selected to act as evidence. Whilst I have aimed to be transparent about the judgements I have made, and present sufficient evidence to justify those judgements, the reader will nevertheless be assessing my construction of the data around issues that I judged to be important. Hodkinson and Hodkinson (2001) say that the reader needs to judge whether or not the analysis presented sounds convincing. Based on what they know of similar situations and circumstances, only the reader will know if it generates an empathy within them.

This medical school's approach to PBL cannot be taken as representative of any other medical school, as even within this one school, individual PBL group sessions differed. Whilst findings from this study cannot be generalised, they can generate new thinking, and this thinking has a validity that does not depend upon the participants from which it is drawn. My theory on PBL can be compared with and judged within other settings, and against the literature. As Hodkinson and Hodkinson (2001) say, if a study is voicing something that is new, and I believe my study is doing so, that in itself is of value.

7.7 What can we conclude?

PBL has been popular within the UK for over two decades now, and continues to have a loyal following. It continues to garner support from those new to PBL and yet there is little evidence that PBL offers a superior method of learning. The contribution that this study aims to make to the body of literature on PBL is to encourage a healthy critical debate, to challenge the status quo and lead to new thinking and new ideas that allow PBL to develop and evolve for the benefit of the student learner.

The small number of participants enabled an exploration of the complexity surrounding the students' experience, revealing that demands on the students to successfully complete a medical degree impacted on their interpretation of and engagement with PBL. PBL is capable of dynamic adaptation to curriculum content, and of being updated, but the medical educational curriculum design and assessments also need to ensure that it is relevant to the present day.

One of the strengths of this study is that it retains the 'noise' of real life, a term used by Hodkinson and Hodkinson (2001). Previously published research on PBL excluded the participants' views as part of that 'noise'. This study aimed to redress the balance. The students were important to me as a PBL tutor and so became the focus of the research questions within this study. In a student-centered learning environment, it must surely be good educational practice to take into account students' perceptions of PBL in practice.

PBL had a chance to rapidly disseminate during a time when medical education was in crisis, and the GMC was a powerful sponsor with its commitment to finding solutions. Empirical educational research tried to capture information that supported PBL, but its rapid dissemination can be better understood as an example of a social movement within the medical education fraternity. Adoption of PBL has been associated with prestige. Yet it is likely that different medical schools adopted only parts, and the innovation of PBL underwent a transformation. All these aspects may explain why the expected healthy critique of and reflection on PBL has not occurred. House (1974) believes that overselling an educational innovation can result in disillusionment on the part of those students who must use it. There is evidence that this is the case with PBL.

The present lack of a balanced critique of PBL, I believe, is limiting its development. This thesis has offered a critique based on analysis of the students' perspective, and suggests an explanation as to why students are not fully adopting the PBL approach.

This study explored the empirical basis for my perceptions and has offered insight into developing ideas on how it might be possible to strengthen learning through PBL. PBL offers a means whereby students can develop individual self-awareness and self-connectedness and an awareness of others, so that they are supported in graduating as doctors who are purposeful and ethical in their actions. However, in practice, medical students are misinterpreting PBL's role in preparing them for graduation. In order to consider these conclusions further, it would be useful for future work to include evaluations of students' views and experiences following graduation, exploring the influence PBL has once they are engaged in day-to-day 'problem solving', and to what extent they are prepared to negotiate with other doctors and with patients.

References

Albanese, M.A. and Mitchell, S. (1993) 'Problem-based learning: a review of literature on its outcomes and implementation issues', *Academic Medicine*, 68(1), pp. 52-81.

Almoudaris, A., Ferguson, C. and Girgis, S. (2003) *The insiders' guide to medical schools 2003/2004: reports from BMA Medical Students' Committee.* London: BMJ.

Bandura, A. (1982) 'Self-efficacy mechanism in human agency', *American Psychologist*, 37(2), pp. 122–147.

Banfield, G. (2004) 'What's really wrong with ethnography?' *International Education Journal*, 4(4), pp. 53–63.

Baroffio, A., Vu, N.V. & Gerbase, M.W, (2013) Evolutionary trends of problem-based learning practices throughout a two-year preclinical program: a comparison of students' and teachers' perceptions. *Advances in Health Sciences Education*, 18(4), pp.673–685.

Barrows, H.S. (1984) 'A specific problem-based, self-directed learning method designed to teach medical problem-solving skills, and enhance knowledge retention and recall, in Schmidt, H.G. and de Volder, M. (eds), *Tutorials in problem-based Learning: A new direction in teaching the health professions*. Maastricht: Van Gorcum, pp. 16–32.

Barrows, H.S. (1985) *How to design a problem-based curriculum for the preclinical years*, New York: Springer Pub. Co.

Barrows, H.S. (1986) 'A taxonomy of problem-based learning methods', *Medical Education*, 20(6), pp. 481–486.

Barrows, H.S. (2000) *Problem-based learning applied to medical education*, Springfield: Southern Illinois University School of Medicine.

Barrows, H.S. and Tamblyn, R.M. (1980) *Problem-based learning: an approach to medical education*, New York: Springer Pub. Co.

Batchelder, A.J., Rodrigues, C.M.C., Lin, L.Y., Hickey, P.M., Johnson, C. and Elias, J.E. (2010) 'The role of students as teachers: Four years' experience of a large-scale, peer-led programme', *Medical Teacher,* 32(7), pp. 547–551.

Bate, E., Hommes, J., Duvivier, R. and Taylor, D.C.M. (2014) 'Problem-based learning (PBL): getting the most out of your students - their roles and responsibilities: AMEE Guide No. 84', *Medical Teacher*, 36(1), pp. 1-12.

Bate, E. and Taylor, D.C.M. (2013) 'Twelve tips on how to survive PBL as a medical student', *Medical Teacher,* 35(2), pp. 95-100.

Berger, J. (2008) *Ways of seeing.* London: Penguin.

Berkson, L. (1993) 'Problem-based learning: have the expectations been met?', *Academic Medicine*, 68(10 Suppl), pp. s79-88.

Bhattacharya, N., (1998) Students' perceptions of problem-based learning at the B.P. Koirala Institute of Health Sciences, Nepal. *Medical Education*, 32, pp.407–410.

Bigsby, E., Mcmanus, I.C., Sedgwick, P. & McCrorie, P. (2010) 'Which medical students like problem-based learning?' [Online] Available at: http://www.ucl.ac.uk/medical-education/publications/unpublished-manuscripts/Who_likes_problembased_learning2.pdf (Accessed: 6 April 2014).

Blumberg, P. (2000) 'Evaluating the evidence that problem-based learners are self-directed learners: A review of the literature', in Evensen, D. H. and Hmelo-Silver, C. E. (eds) *Problem-based learning: A research perspective on learning interactions*. Mahwah, N.J: L. Erlbaum Associates, pp. 199–226.

Blumberg, P., Michael, J. and Zeitz, H. (1990) 'Roles of student-generated learning issues in problem-based learning', *Teaching and Learning in Medicine*, 2(3), pp.149–154.

Booth, A., McLean, M. and Walker, M. (2009) Self, others and society: a case study of university integrative learning. *Studies in Higher Education* 34, pp.929–939.

Boud, D. and Feletti, G. (1991) *The Challenge of problem based learning.* New York: St. Martin's Press.

Burgess, A., McGregor, D. and Mellis, C. (2014) 'Medical students as peer tutors: a systematic review', *Medical Education*, 14(1), p.115.

Cavenagh, P., Leinster, S.J. and Miles, S. (eds), (2011) *The changing face of medical education.* Oxford ; New York: Radcliffe Pub.

Cebeci, S., Dane, S., Kaya, M. and Yigitoglu, R. (2013) 'Medical Students' Approaches to Learning and Study Skills', *Procedia - Social and Behavioral Sciences*, 93, pp.732–736.

Charlin, K., Mann, P. and Hansen, B. (1998) 'The many faces of problem-based learning: a framework for understanding and comparison', *Medical Teacher*, 20(4), pp.323–330.

Chatterjea, R.G. and Mitra, A. (1976) 'A study of brainstorming', *Manas*, 23(1), pp.23–28.

Chi, M.T.H., DeLeeuw, N., Chiu, M., and LaVancher, C. (1994) 'Eliciting self-explanations improves understanding', *Cognitive Science* 18, pp.439–477.

Ciechan, J., Girgis, S. and Smith, P. (eds) (2004) *The insiders' guide to medical schools 2004/2005: the alternative prospectus compiled by the BMA Medical Students Committee*. Oxford: Blackwell.

Cilliers, F.J., Schuwirth, L.W.T., Herman, N., Adendorff, H.J. and van der Vleuten, C.P.M. (2012) 'A model of the pre-assessment learning effects of summative assessment in medical education', *Advances in Health Sciences Education*, 17(1), pp.39–53.

Clough, P. and Nutbrown, C. (2012) *A student's guide to methodology: justifying enquiry.*3rd edn. London: Sage.

Couto, L.B., Bestetti, R.B., Restini, C.B.A., Faria-Jr, M., Romão, G.S, (2015) Brazilian medical students' perceptions of expert versus non-expert facilitators in a (non) problem-based learning environment. *Medical Education Online* 20. Available at: http://www.med-ed-online.net/index.php/meo/article/view/26893 [Accessed January 24, 2016].

Cruess, S.R. and Cruess, R.L. (2005) 'The medical profession and self-regulation: a current challenge', *The virtual mentor* : 7(4) [Online]. Available at: http://journalofethics.ama-assn.org/2005/04/oped1-0504.html (Accessed: 22 November 2014).

Das Carlo, M., Swadi, H. & Mpofu, D., 2003. Medical Student Perceptions of Factors Affecting Productivity of Problem-Based Learning Tutorial Groups: Does Culture Influence the Outcome? *Teaching and Learning in Medicine*, 15(1), pp.59–64.

David, T.J., Patel, L., Burdett, K. and Rangachari, P. (1999) *Problem-based learning in medicine: a practical guide for students and teachers.* London, UK ; Lake Forest, IL: Royal Society of Medicine Press.

Davis, M.H. (1999) 'AMEE Medical Education Guide No. 15: Problem-based learning: a practical guide', *Medical Teacher*, 21(2), pp.130–140.

De Grave, W.S., Boshuizen, H.P.A. and Schmidt, H.G. (1996) 'Problem based learning: Cognitive and metacognitive processes during problem analysis', *Instructional Science*, 24(5), pp.321–341.

De Grave, W.S., Dolmans, D. & Van Der Vleuten, C.P.M, (1999) Profiles of effective tutors in problem-based learning: scaffolding student learning. *Medical Education*, 33, pp.901–906.

De Grave, W.S., Dolmans, D. & Van Der Vleuten, C.P.M, (2002) Student Perspectives on Critical Incidents in the tutorial Group. *Advances in Health Sciences Education*, 7, pp.201–209.

De Munck, V.C. and Sobo, E.J. (eds) (1998) *Using methods in the field: a practical introduction and casebook.* AltaMira Press, Walnut Creek, CA.

Denscombe, M. (2014) *The good research guide for small-scale social research projects.* Maidenhead : McGraw Hill Education/Open University Press, Available at: http://search.ebscohost.com/login.aspx?direct=true&db=cat01883a&AN=uea.003879223&authtype=sso&custid=s8993828&site=eds-live&scope=site. [Accessed: 24 April 2015]

Department of Health (2000) *Improving working lives standard.* London, UK; Department of Health

Dewey, J. (1938) *Experience and education*, New York: Simon and Schuster.

Diehl, M. and Stroebe, W. (1987) 'Productivity loss in brainstorming groups: Toward the solution of a riddle', *Journal of Personality and Social Psychology*, 53(3), pp.497–509.

Diehl, M. and Stroebe, W. (1991) 'Productivity loss in idea-generating groups: Tracking down the blocking effect', *Journal of Personality and Social Psychology*, 61(3), pp.392–403.

Dixon, A., (2000) “Problem-based learning: old wine in new bottles?”, in: Tan, O.S., Little, P., Hee, S.Y., and Conway, J. (Eds.), Problem-Based Learning: Educational Innovation Across Disciplines - a Collection of Selected Papers. Temasek Centre for Problem-Based Learning, Singapore, pp. 34-45.

Dolmans, D.H., De Grave, W., Wolfhagen, I.H.A.P., and van der Vleuten, C.P.M. (2005) 'Problem-based learning: future challenges for educational practice and research', *Medical Education*, 39(7), pp.732–741.

Dolmans, D.H. and Schmidt, H. (1994) 'What drives the student in problem-based learning?' *Medical Education,* 28(5), pp.372–380.

Dolmans, D.H., Schmidt, H.G. and Gijselaers, W.H. (1994) 'The relationship between student-generated learning issues and self-study in problem-based learning', *Instructional Science*, 22(4), pp.251–267.

Dolmans, D.H., Wolfhagen, I.H., Van Der Vleuten, C.P. and Wijnen, W.H. (2001) 'Solving problems with group work in problem-based learning: hold on to the philosophy', *Medical Education*, 35(9), pp.884–889.

Drucker, P.F. (1969) *The Age of Discontinuity: Guidelines to our changing society.* New York: Harper & Row.

Ellaway, R.H., Pusic, M., Yavner, S. and Kalet, A.L. (2014) 'Context matters: emergent variability in an effectiveness trial of online teaching modules', *Medical Education*, 48(4), pp.386–396.

Engel, C.E. (1991) 'Not just a method but a way of learning', in Boud, D. and Feletti, G. (eds) *The Challenge of problem based learning*. New York: St. Martin's Press.
Evensen, D.H. and Hmelo-Silver, C.E. (eds) (2000) *Problem-based learning: a research perspective on learning interactions.* Mahwah, N.J: L. Erlbaum Associates.

Evensen, D.H., Salisbury-Glennon, J.D. and Glenn, J. (2001) 'A qualitative study of six medical students in a problem-based curriculum: Toward a situated model of self-regulation', *Journal of Educational Psychology*, 93(4), pp.659–676.

Firth-Cozens, J. (1989) 'Stress in medical undergraduates and house officers', *British Journal of Hospital Medicine*, 41(2), pp.161–164.

Frambach, J.M., Driessen, E.W., Beh, P., van der Vleuten, C.P.M, (2014) Quiet or questioning? Students' discussion behaviors in student-centered education across cultures. *Studies in Higher Education*, 39(6), pp.1001–1021.

Frankham, J., Smears, E., (2012) Choosing not choosing: the indirections of ethnography and educational research. *Discourse: Studies in the Cultural Politics of Education* 33, pp.361–375.

General Medical Council, (1980) *Recommendations on basic medical education,* London: General Medical Council

General Medical Council, (1993) *Tomorrow's Doctors, London: General Medical Council*

Gijselaers, W. (1995) 'Perspectives on problem-based learning', in Gijselaers, W., Tempelaar, D. T. and Keizer, P. K. (eds) *Educational Innovation in Economics and Business Administration*. New York: Springer, pp. 39–52.

Gijselaers, W.H. and Schmidt, H.G. (1992) '*Exploring a model of study time allocation in a problem-based medical curriculum*'. Annual Meeting of the American Educational Research Association in San Francisco, CA, April 20-24, Available at: http://eric.ed.gov/?id=ED347881 (Accessed: 7 March 2015)

Ginty, A. (2007) 'Problem Based Learning', *ESCalate*. Available at: https://www.heacademy.ac.uk/sites/default/files/3570.pdf. (Accessed: 30 November 2014)

Girgis, S., Bissett, L., and Burke, D. (2007) *The insider's guide to UK medical schools 2007/2008.* Oxford: Blackwell.

Gormley, G. (2011) 'Summative OSCEs in undergraduate medical education', *The Ulster Medical Journal*, 80(3), pp.127–132.

Gubrium, J.F. and Holstein, J.A. (eds) (2002) *Handbook of interview research: context & method.* Thousand Oaks, Calif: Sage Publications.

Gureckis, T.M. and Markant, D.B. (2012) 'Self-Directed Learning: A Cognitive and Computational Perspective', *Perspectives on Psychological Science*, 7(5), pp.464–481.

Hall, M., Clegg, S.R., Sillince, J. (2008) The Importance of Learning to Differentiate between 'Hard' and 'Soft' Knowledge. *Communications of the IBIMA* 6, pp67-74.

Hammond, M. and Collins, R. (1991) *Self-directed learning: critical practice.* London: Kogan Page.

Hendry, G.D., Lyon, P.M., Prosser, M., and Sze, D., (2006) 'Conceptions of problem-based learning: the perspectives of students entering a problem-based medical programme', *Medical Teacher* 28, pp.573–575.

Hendry, G.D., Phan, H., Lyon, P.M., Gordon, J., (2002) Student evaluation of expert and non-expert problem-based learning tutors. *Medical Teacher*, 24(5), pp.544–549.

Hmelo-Silver, C. (2004) 'Problem-Based Learning: What and How Do Students Learn?' *Educational Psychology Review*, 16(3), pp.235–266.

Hodkinson, P. and Hodkinson, H. (2001) *The Strengths and Limitations of Case Study Research*. Learning and Skills Development Agency Conference, Cambridge, 5-7 December. Available at: LE_PH_PUB_05.12.01.rtf (Accessed: 3 May 2015).

Holmes, D.B. and Kaufman, D.M. (1994) 'Tutoring in problem-based learning: a teacher development process', *Medical Education*, 28(4), pp.275–283.
House, E.R. (1974) *The politics of educational innovation.* Berkeley, Calif: McCutchan Pub. Corp.

Hughes Caplow, J.A., Donaldson, J.F., Kardash, C., Hosokawa, M., (1997) Learning in a problem-based medical curriculum: students' conceptions. *Medical Education* 31, pp.440–447.

Jennings, P. (2013) PBL but not as we know it: An ethnography of the practice and facilitation of problem-based learning within a hybrid graduate-entry medical programme in England (Doctoral dissertation). University of Nottingham. Retrieved from Ethos database, Order details uk.bl.ethos.602367.

Jiménez-Mejías, E., Amezcua-Prieto, C., Martínez-Ruiz, V., Olvera-Porcel, M.C., Jiménez-Moleón, J.J., Lardelli Claret, P., (2015) Medical students' satisfaction and academic performance with problem-based learning in practice-based exercises for epidemiology and health demographics. *Innovations in Education and Teaching International* 52, pp.510–521.

Jones, G.L., Bligh, J.G. and Valentine, C. (1996) 'Venus and Freud: an educational opportunity?' *Genitourinary medicine*, 72(4), pp.290–294.

Kantar, L. (2014) 'Incorporation of constructivist assumptions into problem-based instruction: A literature review', *Nurse Education in Practice* 14, pp.233–241.

Kemp, S. (2011) Constructivism and problem-based learning [WWW Document]. Singapore: Temasek Polytechnic, Learning Academy. Available at: http://www.tp.edu.sg/staticfiles/TP/files/centres/pbl/pbl_sandra_joy_kemp.pdf [Accessed January 10, 2016].

Kicken, W. Brand-Gruwel, S., van Merriënboer, J.J.G. and Slot, W. (2009) 'The effects of portfolio-based advice on the development of self-directed learning skills in secondary vocational education', *Educational Technology Research and Development*, 57(4), pp.439–460.

Kirschner, P. (1992) 'Epistemology, practical work and Academic skills in science education', *Science & Education*, 1(3), pp.273–299.

Kirschner, P.A., Sweller, J. and Clark, R.E. (2006) 'Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching', *Educational Psychologist*, 41(2), pp.75–86.

Knobe, M., Münker, R., Sellei, R.M., Holschen, M., Mooij, S.C., Schmidt-Rohlfing, B., Niethard, F.-U., and Pape, H.-C. (2010) 'Peer teaching: a randomised controlled trial using student-teachers to teach musculoskeletal ultrasound', *Medical Education*, 44(2), pp.148–155.

Koh, G.C.-H. Khoo, H.E., Wong, M.L., and Koh, D. (2008) 'The effects of problem-based learning during medical school on physician competency: a systematic review', *Canadian Medical Association journal* 178(1), pp. 34-41.

LaMarca, N., (2011) The Likert Scale: Advantages and Disadvantages. Field Research in Organizational Psychology.
Available at: https://psyc450.wordpress.com/author/nickycole76/ [Accessed February 7, 2016].

Lauridsen, B. (2012) *Problem-based Learning applied to Team Environments: A Visual Literature Review*. Teaching Colleges and Community Worldwide Online Conference, Available at: http://etec.hawaii.edu/proceedings/2012/lauridsen.pdf (Accessed 21 November 2011).

Lonka, K. & Lindblom-Ylanne, S., (1996) Epistemologies, conceptions of learning, and study practices in medicine and psychology. *Higher Education*, 31, pp.5–24.

Lowry, S. (1992) 'What's wrong with medical education in Britain?' *British Medical Journal*, 305(6864), pp.1277–1280.

Loyens, S.M.M., Rikers, R.M.J.P., and Schmidt, H.G. (2007) 'Students' conceptions of distinct constructivist assumptions', *European Journal of Psychology of Education* pp.179-199.

Lundvall, B. and Johnson, B. (1994) 'The Learning Economy', *Journal of Industry Studies*, 1(2), pp.23–42.

MacDonald, B. and Walker, R. (1975) 'Case study and the Social Philosophy of Educational Research', *Cambridge Journal of Education*, 5(1), pp.2–11.

Margetson, D.B. (1999) 'The relation between understanding and practice in problem-based medical education', *Medical Education*, 33(5), pp.359–364.

Marton, F. and Säljö, R. (1997) 'Approaches to learning', in Marton, F., Hounsell, D. J. and Entwistle, N. J. (eds) *The Experience of Learning*. Edinburgh: Scottish Academic Press., pp. 39–58.

Maudsley, G., (1999) 'Do we all mean the same thing by "problem-based learning"? A review of the concepts and a formulation of the ground rules', *Academic Medicine*, 74(2), pp.178–185.

Maudsley, G., Williams, E.M.I. & Taylor, D.C.M., (2008) Problem-based learning at the receiving end: A "mixed methods" study of junior medical students' perspectives. *Advances in Health Sciences Education*, 13(4), pp.435–451.

McLoughlin, C.S. (2009) 'Characteristics of Students Failing Medical Education: An Essay of Reflections', *Medical Education Online*, (14), pp.1–6. [Online] DOI:10.3885/meo.2009.L0000029 (Accessed: 7 March 2015)

McManus, C. (2011) Peter Richards - Obituary. Available at: https://www.ucl.ac.uk/medical-education/medical-education-studies/PeterRichards/Peter_Richards-Obituary-LongVersion.pdf. (Accessed: 10 May 2015)

Miflin, B. (2004) 'Small groups and problem-based learning: are we singing from the same hymn sheet?' *Medical Teacher*, 26(5), pp.444–450.

Miflin, B.M., Campbell, C.B. and Price, D.A. (2000) 'A conceptual framework to guide the development of self-directed, lifelong learning in problem-based medical curricula', *Medical Education*, 34(4), pp.299–306.

Moore, G.T., Block, S.D., Style, C.B., Mitchell, R. (1994) 'The influence of the New Pathway curriculum on Harvard medical students', *Academic Medicine,* 69(12), pp.983–989.

Mullen, B., Johnson, C. and Salas, E. (1991) 'Productivity loss in brainstorming groups: A meta-analytic integration', *Basic and Applied Social Psychology*, 12(1), pp.3–23.

Musal, B., Gursel, Y., Taskiran, H.C., Ozan, S., Tuna, A., (2004) Perceptions of first and third year medical students on self-study and reporting processes of problem-based learning. *BMC Medical Education* 4, pp.1–7.

Nathan, R. (2006) *My freshman year: what a professor learned by becoming a student.* New York N.Y.: Penguin Books.

Neufeld, V.R., Woodward, C.A. and MacLeod, S.M. (1989) 'The McMaster M.D. program: a case study of renewal in medical education', *Academic Medicine*, 64(8), pp.423–432.

Newman, C. (1957) *The Evolution of Medical Education in The Nineteenth Century.* Oxford : Oxford University Press.

Newman, M. (2003). *A pilot systematic review and meta-analysis on the effectiveness of problem based learning: on behalf of the Campbell Collaboration Systematic Review Group on the effectiveness of Problem Based Learning*, Heslington, York [Online]
Available at:
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.133.6561&rep=rep1&type=pdf (Accessed: 19 April 2015)

Norman, G. (2008) 'Problem-based learning makes a difference. But why?', *Canadian Medical Association Journal*, 178(1), pp.61–62.

Norman, G.R. and Schmidt, H.G. (1992) 'The psychological basis of problem-based learning: a review of the evidence', *Academic Medicine,* 67(9), pp.557–565.

O'Donnell, A.M. (2006) 'The Role of Peers and Group Learning', in Alexander, P. A. and Winne, P. H. (eds) *Handbook of educational psychology*. Mahwah, NJ, US: Lawrence Erlbaum Associates, pp. 781–802.

Olson, J.O. (1987) 'The McMaster philosophy: a student's perspective on implementation', *Medical Education*, 21(4), pp.293–296.

Osborn, A.F. (1957) *Applied imagination : principles and procedures of creative thinking.* Rev. edn. New York: Charles Scribner's Sons.

Patton, M.Q. (2002) *Qualitative research and evaluation methods*. Thousand Oaks, Calif. ; London : Sage.

Pecorari, D. (2010) *Academic writing and plagiarism: a linguistic analysis*, London: Continuum.

Phillips, D.C. (1995) 'The Good, the Bad, and the Ugly: The Many Faces of Constructivism', *Educational Researcher* 24, pp.5–12.

Pink, S. (2013) *Doing visual ethnography* 3rd edn. Los Angeles: Sage.

Pinsonneault, A., Barki, H., Gallupe, R.B. and Hoppen, N. (1999) 'Electronic brainstorming: The illusion of productivity', *Information Systems Research*, 10(2), pp.110–133.

Piumatti, S. (2010) *Getting into medical school: 2011 entry*. Richmond: Trotman.

Reid, W.A., Evans, P. and Duvall, E. (2012) 'Medical students' approaches to learning over a full degree programme', *Medical Education Online*, 17 [Online] Available at: http://www.med-ed-online.net/index.php/meo/article/view/17205 [Accessed 2 May 2015].

Richards, P. (1993) *Learning medicine 1994: an informal guide to a career in medicine.* London: British Medical Association.

Richardson, J.T.E. (1994) 'Mature students in higher education: I. A literature survey on approaches to studying', *Studies in Higher Education*, 19(3), pp.309–325.

Richardson, J.T.E. (1995) 'Mature students in higher education: II. An investigation of approaches to studying and academic performance', *Studies in Higher Education*, 20(1), pp.5–17.

Ritchie, J., Lewis, J., McNaughton Nicholls, C., Ormston, R. [Eds.] (2014) *Qualitative research practice: a guide for social science students and researchers*, Second edition. ed. Sage, Los Angeles.

Rubin, H.J., Rubin, I. (2005) *Qualitative Interviewing: the art of hearing data*. Sage Publications, Thousand Oaks, Calif.

Ryen, A. (2011) 'Ethics and qualitative research', in Silverman, D. (ed.) *Qualitative research: issues of theory, method, and practice*. Los Angeles: Sage.

Saldaña, J. (2013) *The coding manual for qualitative researchers.* 2nd edn. Los Angeles: Sage.

Sanson-Fisher, R.W. and Lynagh, M.C. (2005) 'Problem-based learning: a dissemination success story?' *Medical Journal of Australia*, 183(5), pp.258–260.

Schmidt, H.G. (1983) 'Problem-based learning: rationale and description', *Medical Education*, 17(1), pp.11–16.

Schmidt, H.G. (1993) 'Foundations of problem-based learning: some explanatory notes', *Medical Education*, 27, pp.422–432.

Schmidt, H.G. & Moust, J.H.C., (1995) What Makes a Tutor Effective – a Structural;-Equations Modeling Approach to Learning in Problem-Based Curricula. Academic Medicine, 70(8), pp.708-714.

Schmidt, H.G., Van Der Molen, H.T., Te Winkel, W.W.R., Wijnen, W.H.F.W. (2009), 'Constructivist, Problem-Based Learning Does Work: A Meta-Analysis of Curricular Comparisons Involving a Single Medical School', *Educational Psychologist* 44, pp.227–249.

Sfard, A. (1998) 'On two metaphors for learning and the dangers of choosing just one', *Educational Researcher*, 27(2), pp.4–13.

Shahabudin, S.H. (1987) 'Content coverage in problem-based learning', *Medical Education*, 21(4), pp.310–313.

Shankar, P.R. and Nandy, A., (2014) Student feedback on problem-based learning processes. *Australasian Medical Journal*, pp.522–529.

Silverman, D. (2011) *Interpreting qualitative data: a guide to the principles of qualitative research* 4th edn. Los Angeles: Sage.

Simons, H. (2009) *Case study research in practice.* Los Angeles ; London: Sage.

Sinclair, S. (1997) *Making doctors: the institutional apprenticeship of medical students.* Oxford: Berg Publishers.

Skinner, V.J., Winning, T.A., Braunack-Mayer, A., Mullins, G. and Peterson, R. (2004) *PBL Groups: What are they doing? A student work in progress*. South Australia: The University of Adelaide.

Slavin, R.E. (1983) 'When does cooperative learning increase student achievement?' *Psychological Bulletin*, 94(3), pp.429–445.

Stajkovic, A.D., Lee, D. and Nyberg, A.J. (2009) 'Collective efficacy, group potency, and group performance: Meta-analyses of their relationships, and test of a mediation model', *Journal of Applied Psychology*, 94(3), pp.814–828.

Steinert, Y., (2004) Student perceptions of effective small group teaching. *Medical Education*, 38, pp.286–293.

Stonyer, H. and Marshall, L. (2002) 'Moving to problem-based learning in the NZ engineering workplace', *Journal of Workplace Learning*, 14(5), pp.190–197.

Strobel, J. & van Barneveld, A., (2009) When is PBL More Effective? A Meta-synthesis of Meta-analyses Comparing PBL to Conventional Classrooms. *Interdisciplinary Journal of Problem-Based Learning*, 3(1). Available at: http://docs.lib.purdue.edu/ijpbl/vol3/iss1/4 [Accessed January 23, 2016].

Tang, C. (1994) 'Assessment and student learning. Effects of modes of assessment on students' preparation strategies, in Gibbs, G. (ed.) *Improving Student Learning - Theory and Practice*. Oxford: The Oxford Centre for Staff Development, pp. 151 – 170.

Taylor, D.C.M. and Hamdy, H. (2013) 'Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83', *Medical Teacher*, 35(11), pp.e1561–e1572.

Taylor, D. and Miflin, B. (2008) 'Problem-based learning: where are we now?' *Medical teacher*, 30(8), pp.742–763.

Taylor, R. (1987) 'Selecting effective courseware: Three fundamental instructional factors', *Contemporary Educational Psychology*, 12(3), pp.231–243.

Towle, A. (1991) *Critical thinking: the future of undergraduate medical education: a study by the King's Fund Centre in collaboration with St. Bartholomew's Hospital Medical College.* London: King's Fund Centre.

Urmston, I. (ed.) (1998) *The Insider's guide to medical schools: the alternative prospectus.* London: BMJ Books.

Utting, M.R., Campbell, F., Rayner, C., Whitehouse, C.R., and Dornan, T.L. (2000) 'Consultation skills of medical students before and after changes in curriculum', *Journal of the Royal Society of Medicine*, 93(5), pp.247–253.

Van Blankenstein, F., Dolmans, D.J.M., van der Vleuten, C.M., and Schmidt, H. (2011) 'Which cognitive processes support learning during small-group discussion? The role of providing explanations and listening to others', *Instructional Science*, 39(2), pp.189–204.

Van de Vleuten, C. (2014) 'Assessment. The evidence from the literature', *International Advanced Assessment Course*. 27 October 2014. London, UK.

Vernon, D.T. and Blake, R.L. (1993) 'Does problem-based learning work? A meta-analysis of evaluative research', *Academic Medicine,* 68(7), pp.550–563.

Visschers-Pleijers, A.J.S.F. Dolmans, D.H.J.M., Wolfhagen, I.H.A.P., Vleuten, C.P.M.V. der., (2005) Student Perspectives on Learning-Oriented Interactions in the Tutorial Group. *Advances in Health Sciences Education*, 10(1), pp.23–35.

Visschers-Pleijers, A.J.S.F. Dolmans, D.H.J.M., De Grave, W.S., Wolfhagen, I.H.A.P., Jacobs, J.A., van der Vleuten, C.P.M., (2006) Student perceptions about the characteristics of an effective discussion during the reporting phase in problem-based learning. *Medical Education*, 40(9), pp.924–931.

Walton, H.J. and Matthews, M.B. (1989) 'Essentials of problem-based learning', *Medical Education*, 23(6), pp.542–558.

Watmough, S., Taylor, D. and Garden, A. (2006) 'Educational supervisors evaluate the preparedness of graduates from a reformed UK curriculum to work as pre-registration house officers (PRHOs): a qualitative study', *Medical Education*, 40(10), pp.995-1001.

Watts, S. (2013) 'User Skills for Qualitative Analysis: Perspective, interpretation and the delivery of Impact', *Qualitative Research in Psychology*, 11(1), pp.1–14.

Way, D.P., Hudson, A. and Biagi, B. (2000) 'Comparison of three parallel, basic science pathways in the same medical college', *Academic medicine*, 75(10 Suppl), pp.S118–120.

Welsby, P.D. (1999) 'Reductionism in medicine: some thoughts on medical education from the clinical front line', *Journal of Evaluation in Clinical Practice*, 5(2), pp.125–131.

Whittle, S.R. and Eaton, D.G.M. (2001) 'Attitudes towards transferable skills in medical undergraduates', *Medical Education*, 35(2), pp.148–153.

Wood, D.F. (2008) 'Problem based learning', *British Medical Journal*, 336(7651), p.971.

Woods, D.R. (1994) *Problem-based learning: how to gain the most from PBL.* Waterdown, Ont.: D.R. Woods.

Wormald, B.W., Schoeman, S., Somasunderam, A., and Penn, M. (2009) 'Assessment drives learning: An unavoidable truth?' *Anatomical Sciences Education*, 2(5), pp.199–204.

Yeo, R.K. (2008) 'How does learning (not) take place in problem-based learning activities in workplace contexts?' *Human Resource Development International*, 11(3), pp.317–330.

Yew, E.H.J. & Yong, J.J.Y., (2014) Student perceptions of facilitators' social congruence, use of expertise and cognitive congruence in problem-based learning. *Instructional Science*, 42(5), pp.795–815.

Appendices

Appendix 1

Problem scenario example from Year 4 Module 10 Students Handbook 2012/2013.

During fieldwork this scenario was the week's focus for the observed session with Jennifer's PBL group.

Week 5 Faltering growth

Scenario

Declan is 7 years old and small for his age.

His is brought to his GP by his father, David O'Leary, who says he is wearing the same size clothes as his 5 year-old brother, and his older brother and sister were taller at the same age. Declan was born by caesarean section after slow progress in labour. He weighed 2.8 kg at birth. He has always been a picky eater and suffers frequent upper respiratory tract infections especially since he started pre-school nursery. His family think he has always been small but this has become more marked recently. His bowels are open approximately 3 times a day and are quite loose. On examination, he is small and thin, with weight of 17 kg and height 115cm. His chest is clear, and abdominal examination is unremarkable.

Declan attends the local primary school and is cared for by a child minder when necessary. His father, who is Irish, works as a hospital manager. He is 182cm tall, weighs 82 kg and has asthma. His mother, who is Indian, is a science teacher. She discovered that she had sickle trait when she was pregnant. She is 153cm tall and weighs 55kg. Declan's father says that his cousin's child in Ireland has a problem with her chest and is on a special diet but he doesn't know further details.

Appendix 2

Learning outcomes affiliated to the problem scenario example in Appendix 1. These have been taken from the Year 4 Module 10 Tutor's Handbook 2012/2013.

Learning outcomes for week 5

1. Describe the physiology of normal growth patterns
2. Explain how to plot and interpret growth charts
3. Discuss factors required for normal growth
4. Describe how children's growth is usually monitored
5. Describe patterns of growth during a child's development including family and racial norms
6. Discuss the causes of faltering growth
7. Discuss the impact of diet and eating habits on growth and the emerging problem of childhood obesity.
8. Explain the effects of vitamin and mineral deficiencies on growth
9. Discuss the impact of chronic disease on growth e.g. diabetes mellitus, asthma, congenital heart disease
10. Discuss the process of investigation of a child presenting with faltering growth

Appendix 3. UK medical school's teaching profile 1998 – 2012

	2012	2007	2004	2002	2000	1998
Queens University, Belfast	PBL	PBL	PBL	SDL	SDL	X
University of Birmingham	PBL	PBL	PBL	PBL	X	X
University of Brighton & Sussex	PBL	PBL	PBL	PBL		
University of Bristol	x	SDL	SDL	SDL	SDL	SDL
University of Cambridge	x	X	X	X	X	X
Derby	PBL	PBL				
University of East Anglia	PBL	PBL	PBL	PBL		
Hull York Medical school	PBL	PBL	PBL			
University of Leeds	Case based learning	x	P solving exercises	P solving exercises	P solving exercises	P solving exercises
University of Leicester	PBL	x	x	x	X	X
University of Liverpool	PBL	PBL	PBL	PBL	PBL	PBL
Imperial College	PBL	PBL	PBL	PBL	PBL	PBL
Guy's, Kings and St Thomas'	PBL	X	X	X	X	X
Bsrt's and The London	PBL	PBL	PBL	PBL	PBL	
Royal Free and University College, London	X	X	X	X	X	X
St George's	PBL	PBL	X	X	X	X
University of Manchester and Keele	PBL	PBL	PBL	PBL	PBL	PBL
University of Newcastle and UDSC	SDL	X	X	X	X	X
University of Nottingham	X	X	X	X	X	X
University of Oxford	X	X	X	X	X	X
Peninsula	PBL	PBL	PBL	PBL		
University of Sheffield	PBL	PBL	PBL	PBL	PBL	SDL
University of Southampton	PBL	X	X	X	X	X
University of Aberdeen	Case based learning	X	PBL	PBL	PBL	PBL
University of Dundee	PBL	PBL	PBL	PBL	PBL	PBL
University of Edinburgh	PBL	PBL	PBL	PBL	PBL	PBL
University of Glasgow	PBL	PBL	PBL	PBL	PBL	PBL
University of St Andrews	x	X	X	X	X	X
University of Wales (Cardiff)	case based learning	SDL	SDL	SDL	SDL	SDL
PBL	19 + 3	16	16	14	10	8
SDL	1	2	2	4	3	3
x	6	11	10	10	11	12
Total	29	29	28	27	24	23

Appendix 4. Participation Information sheet

University of East Anglia

Participant Information Sheet

Project title

A Study Exploring Students' Constructs of Studying and Learning Medicine (within a PBL curriculum)

Invitation

I would like to invite you to take part in a research case study. Before you decide, you need to understand why the research is being done and what it would involve for you. Please read the following information carefully and take time to decide whether or not you wish to take part.

What is the purpose of the study?

The aim of the study is to help me to understand how a medical student goes about learning within a given PBL week.

Why have I been invited?

In order for me to obtain detailed information on how a student goes about studying within a given week I am inviting between 4 to 8 students to be researched as a case study. I would like to research students who have successfully undergone three completed years studying within a PBL curriculum and who have achieved either Band A or B for either their ANP or their IP OSCE in year 3. A number of student case studies will then be used to gain an understanding of studying medicine within a PBL curriculum at undergraduate level. I am interested in what it is that makes studying successful enough to be turned into successful learning.

Do I have to take part?

Taking part in the research is entirely voluntary. It is up to you to decide.

What will I have to do?

As a research participant I would like to research you for one week during a campus based week. Within this week there are a number of different sources of data I would like to collect in order to build up a complete picture as possible of how a student studies medicine. Some of this data will require your active participation.

I would like to observe you and your group within one PBL session.

I would like a photo of the space that you undertake private study in that given week. This photo is of your home study environment and should not include any people.

I would also like you to note how long and at what time you study in the given week by completing a pre prepared form.

At the end of the week I would like to interview you so that I can explore how you went about studying within a given PBL week.

Expenses and payments
Any data that I ask you to collect should not financially cost you anything. A £30 gift voucher as a thank you for your time will be given to you at your interview.

What will happen if I don't want to carry on with the study?
You are free to stop being a participant at any time, without giving a reason.

What if there is a problem?
If you have a question about any aspect of this study you should contact me and I will do my best to answer it. My name is Maggie Bunting and I can be contacted on 01603 597173. If you have any complaints about the research during your participation then you are encouraged to contact my Head of School (EDU). The contact details can be found below.

Will my taking part in this study be kept confidential?
Data collected from you and about you will be made anonymous. Your own data will have a unique ID that will not allow you to be identified. Your participation within the study may be discussed by yourself, your PBL colleagues are informed that there is a study being undertaken when I sit in on one PBL session.

What will happen with the collected data?
All collected data will be made anonymous and stored securely. The data collected will only be used for this research study.

Who has reviewed the study?
The study has been approved by the EDU Research Ethics Committee.

For further information and contact details
If you think you would like to volunteer for this study, I would like to suggest that we meet first so that we can go through what it would entail before you make any final decision. Your decision to participate or otherwise will not affect your learning experience and/or your assessment and your module lecturers will not be aware of your participation.

Chief investigator
Maggie Bunting RGN, RM, MClinEd, PGCHEP
Lecturer in Medical Education.
Norwich Medical School
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ

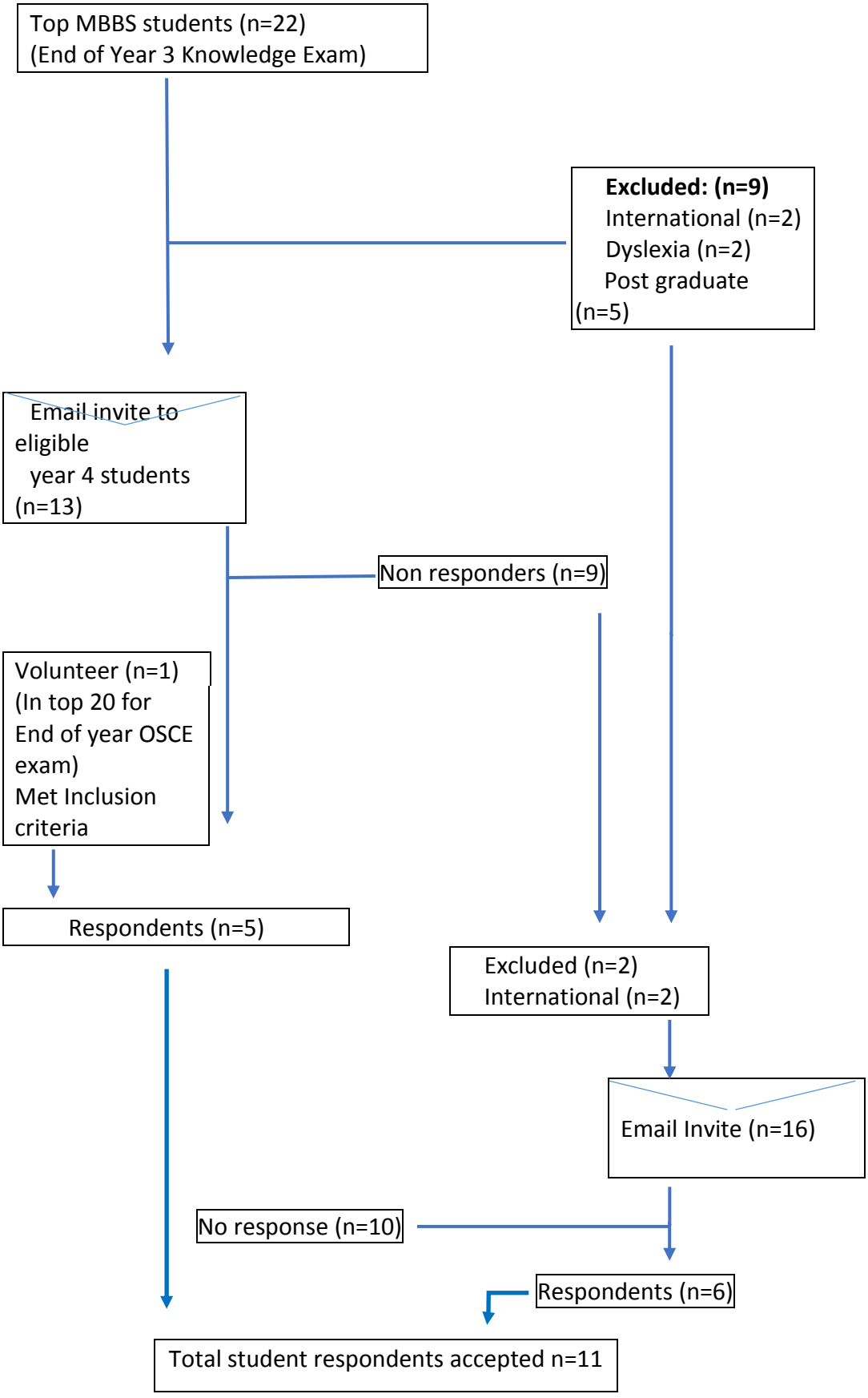
Direct Dial: 01603 597173
Email: M.Bunting1@uea.ac.uk

Supervisor
Professor Nigel Norris
Centre for Applied Research in Education
School of Education and Lifelong Learning
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
Email: N.Norris@uea.ac.uk

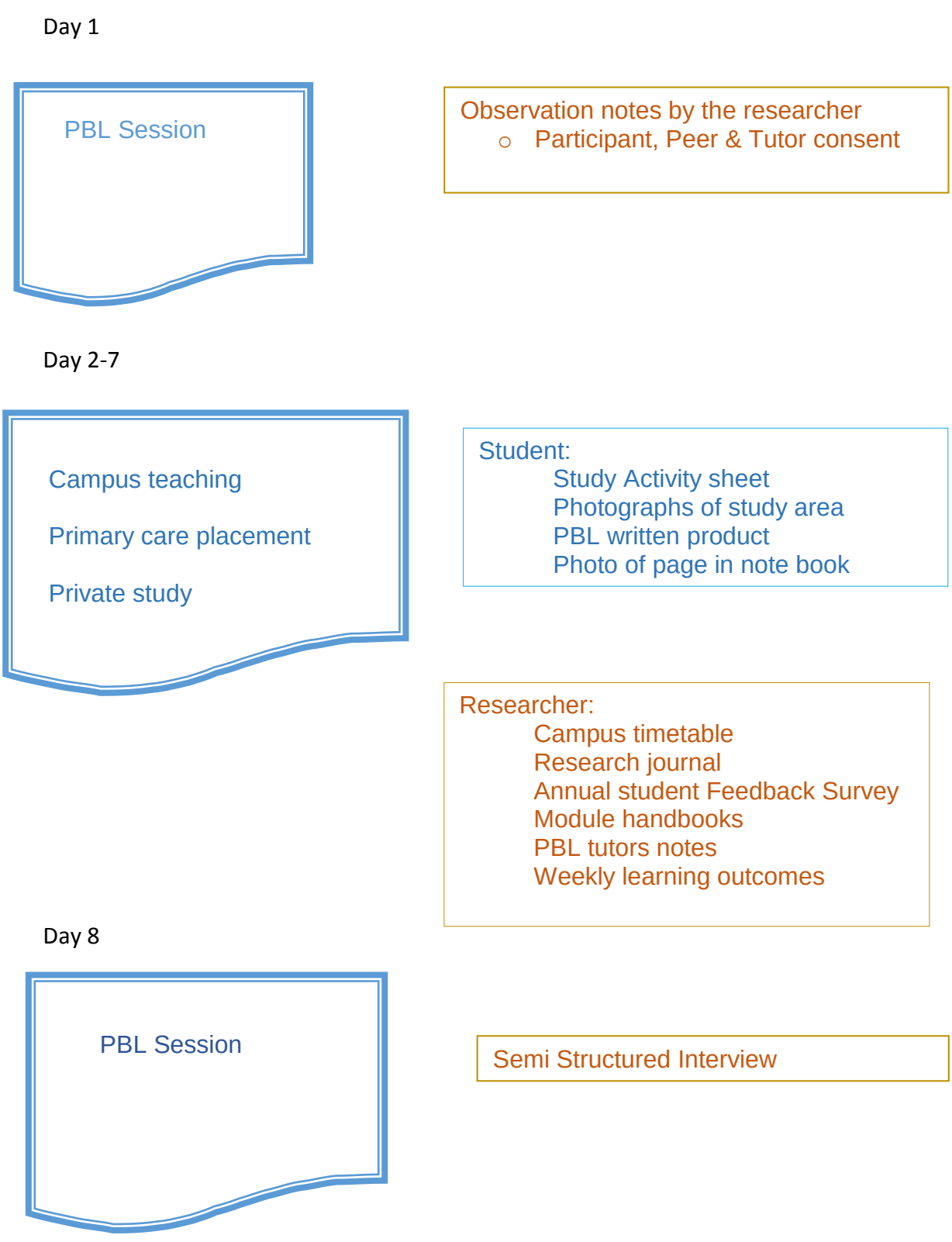
Head of School for education and Lifelong Learning
Dr Nalini Boodhoo
School of Education and Lifelong Learning
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
Email: N.Boodhoo@uea.ac.uk

Please keep this information sheet for your future reference.

Appendix 5. Sample Selection Flowchart



Appendix 6. Flowchart of Data Collection



Appendix 7. Semi-Structured Interview Schedule

Situating the individual:

Did you come straight from 'A' levels? If not what did you do between completing them and commencing the MBBS course.

Tell me about studying for your 'A' levels?

What was your motivational drive to undertake the MBBS course?

Prior to the course how did you go about learning?

Exploring studying and learning in a given PBL week.

Talk me through how you went about studying this week's PBL learning outcome. Where did this take place, who was there?

What other studying did you do this week?

Is this a typical week's studying?

Did you complete everything you would have liked to complete this week? If not, why not.

How important to your learning is the written PBL piece?

What decides when you stop studying a topic (this week's LOs)

What resources have you used this week on BB?

When will you return to this week's LOs?

How far into the future do you look when understanding a topic, do you learn ready for FY1?

Student's interpretation and understanding of PBL

What are the course elements/essential features of the course in terms of studying medicine?

How has your studying changed since studying during your first year?

Can you remember what it was that led to such changes?

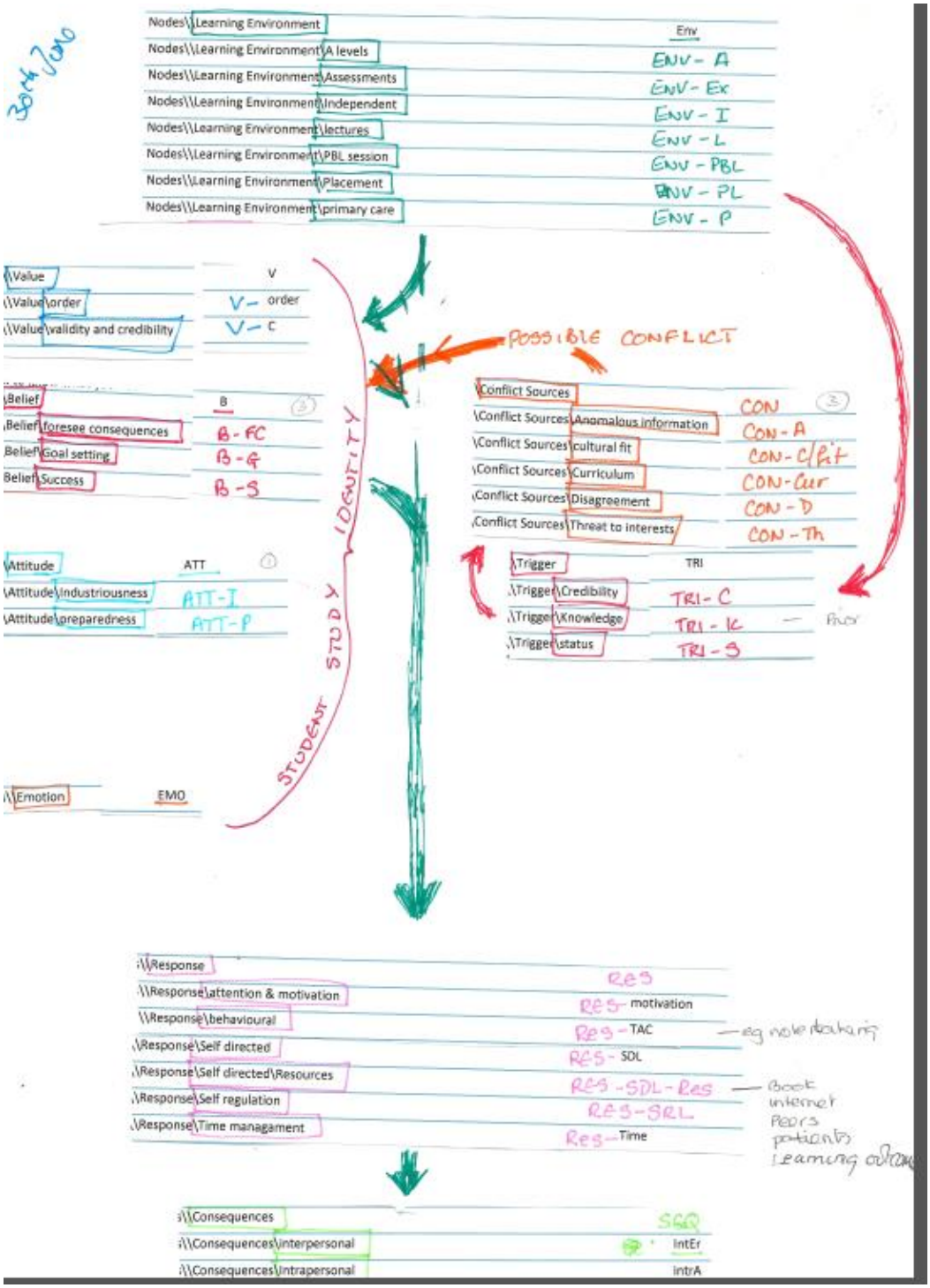
What are the benefits and disadvantages do you think of PBL

Do you think studying PBL will help you when you are a Dr?

How does PBL help you prepare for your examinations?

What are your own expectations of your academic achievement?

Appendix 8. Codebook at mid analysis stage



Appendix 9. Example of coding of a narrative with its accompanying analytic memo.

03R1W7. Yes. Not that I do it the same night but I don't like to spend a huge amount of time on it because it comes to today (day of PBL session) and, you saw when you came to sit in, we don't do formal presentations, we just discuss our work . But the act of doing PBL <pause> has no effect for me, because obviously I have to discuss it this afternoon if you ask me to talk about my PBL topic now, I couldn't tell you a thing. I know what it was on but I could tell you none of the detail, I would have to print off my work now to look at it while I give that talk. So the act of doing PBL , I do not think, for me personally, helps, and as naughty as it is I don't read the other PBL's I just do my notes. I tried, I tried, I thought when I came back this year, I thought I'm going to make a conscious effort of it , we've got an hour and a half's journey to primary care on a Monday, so I loaded them all up on my iPad, and the first two weeks I did try and read through them but , like I said, reading for me is not useful, so that's not happened since, so for the past three weeks I've not read the PBL's. I'll go to the PBL session and , the way we do it this year is different, from how I've ever done it before and I prefer it massively because it's that bit more interactive it's not that didactic PowerPoint where even though it's only meant to be a five or ten minute presentation I'm like, ohh, it's awful . My PBL group this year is ten times better than any PBL group I've had up to now. It's a very cleaver group, It's a very effective and economical in the way it works. Because the process of PBL is so group orientated, if your group doesn't work, PBL does not work, it's as simple as that. If you haven't got a group where people get along, that's not the most important thing, but where people respect other people's ideas, opinions, it just doesn't work. I've had groups in the past, where coming up for the learning objectives will take an hour and a half, and you saw when you came to our PBL group, it took about half an hour, which is a relatively long time for us. Umm but you dread PBL day , you absolutely dread it, because you have to sit through an hour and a half of the worst presentations that you have ever seen in your life and then the actual process of coming up with these outcomes is <pause> dismal, it's really quite depressing.

ENV-PBL 170

Y-C

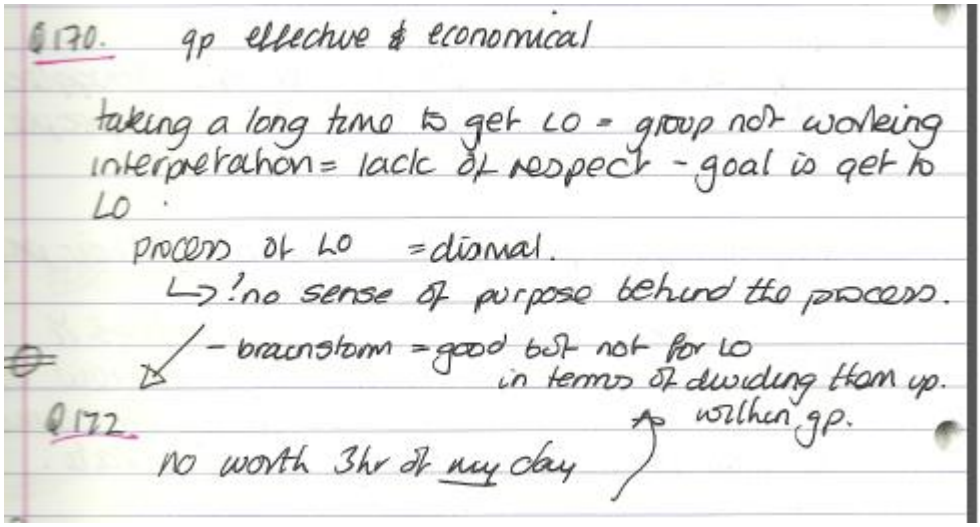
ATT
RES-TAC
RES-SDL

RES-SRL

EMO

V
✓
B-3

V-O
ATT



Appendix 10. Ethics Approval Letter

From: Jacqueline Watson (EDU)
Sent: 13 July 2012 14:36
To: Margaret Bunting (MED)
Cc: Nigel Norris (EDU); Dawn Corby (SSF)
Subject: RE: Ethics submission

Dear Maggie,

Thank you for your revised application and for the additional email with a further revised consent form.

Your revised application has now been reviewed and approved by the EDU research ethics committee. We appreciated its clarity and succinctness and I wish you well with your research.

With best wishes, Jackie.

Dr Jacqueline Watson
Chair EDU Ethics Committee
School of Education and Lifelong Learning University of East Anglia Norwich Research Park Norwich NR4 7TJ, UK

Email: Jacqueline.Watson@uea.ac.uk
Telephone: +44 (0)1603 592924

Appendix 11. Revised participant Information sheet

University of East Anglia

Participant Information Sheet

Project title

A Study Exploring Students' Constructs of Studying and Learning Medicine (within a PBL curriculum)
Phase II

Invitation

I would like to invite you to take part in a research study. Before you decide, you need to understand why the research is being done and what it would involve for you. Please read the following information carefully and take time to decide whether or not you wish to take part.

What is the purpose of the study?

The aim of the study is to help me to understand how a medical student goes about learning within a given PBL week.

Why have I been invited?

In Phase I of the study I invited 5 students to be researched as a case study. The research students had successfully undergone three completed years studying within a PBL curriculum and had achieved Band A for their ANP or OSCE in year 3. These students allowed me to gain an understanding of studying medicine within a PBL curriculum at undergraduate level. The data collected so far raised an interesting hypothesis and in order for me to understand further I would like to interview a larger cohort of the Band A students. I remain interested in what it is that makes studying successful enough to be turned into successful learning.

Do I have to take part?

Taking part in the research is entirely voluntary. It is up to you to decide.

What will I have to do?

As a research participant for Phase II I would like to interview you so that I can explore how you went about studying within a given week. The duration of the interview will be between 30 minutes to an hour.

Expenses and payments

Being a participant should not financially cost you anything.

What will happen if I don't want to carry on with the study?

You are free to stop being a participant at any time, without giving a reason.

What if there is a problem?
If you have a question about any aspect of this study you should contact me and I will do my best to answer it. My name is Maggie Bunting and I can be contacted on 01603 597173. If you have any complaints about the research during your participation then you are encouraged to contact my Head of School (EDU). The contact details can be found below.

Will my taking part in this study be kept confidential?
Data collected from you and about you will be made anonymous. Your own data will have a unique ID that will not allow you to be identified.

What will happen with the collected data?
All collected data will be made anonymous and stored securely. The data collected will only be used for this research study.

Who has reviewed the study?
The study has been approved by the EDU Research Ethics Committee.

For further information and contact details
If you think you would like to volunteer for this study please email me so that we can arrange a suitable time to undertake the interview. Your decision to participate or otherwise will not affect your learning experience and/or your assessment and your module lecturers will not be aware of your participation.

Chief investigator
Maggie Bunting RGN, RM, MClinEd, PGCHEP
Lecturer in Medical Education.
Norwich Medical School
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ

Direct Dial: 01603 597173
Email: M.Bunting1@uea.ac.uk

Supervisor
Professor Nigel Norris
Centre for Applied Research in Education
School of Education and Lifelong Learning
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
Email: N.Norris@uea.ac.uk

Head of School for education and Lifelong Learning
Dr Nalini Boodhoo
School of Education and Lifelong Learning
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
Email: N.Boodhoo@uea.ac.uk

Please keep this information sheet for your future reference.

Appendix 12. Revised consent form

A Study Exploring Students' Constructs of Studying and Learning Medicine (within a PBL curriculum)
Phase II

Consent form
Please tick the boxes and sign below

I have read and understood the information leaflet ❑

I consent to participate in the interview ❑

I consent to the interview being taped ❑

I understand that the results of the research will be used for publication and presentation at education meetings / conferences. ❑
I understand that no personal identifying data will be used in presentations / publications ❑

I understand that excerpts of my interview may be used in publications ❑
I am aware that my participation is voluntary and I can withdraw my consent at any time without explanation ❑

Signature of participant
Date
Name of participant

Signature of researcher
Date
Name of researcher

Appendix 13. Letter of Invitation

A Study Exploring Students' Constructs of Studying and Learning Medicine (within a PBL curriculum)

Letter of invitation

Dear 4th Year medical student

Please find attached an information sheet regarding a research case study exploring the studying of medicine at undergraduate level.

If you do wish to participate, I ask that you complete the slip below and email it to me at M.Bunting1@uea.ac.uk

If you do not wish to participate in this research you do not need to do anything.

Kind regards
Maggie Bunting
Educational Doctorate Research Student.

I **am interested in discussing further about being a research participate** in the above case study.

Name

Email address.

Appendix 14 Study Activity Sheet

A Study Exploring Students' Constructs of Studying and Learning Medicine (within a PBL curriculum)
Study Time Activity Sheet

Unique Student ID														
week start date														
week end date														
	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
	<date>		<date>		<date>		<date>		<date>		<date>		<date>	
Daily study activities	start time	stop time	start time	stop time	start time	stop time	start time	stop time	start time	stop time	start time	stop time	start time	stop time

Appendix 15.

PBL Tutor and Peer Information Sheet

PBL Tutor and Peer Information Sheet

Project title

A Study Exploring Students' Constructs of Studying and Learning Medicine (within a PBL curriculum)

Invitation

A student within your PBL group has agreed to take part in a research case study. As their PBL tutor/colleague, you need to understand why the research is being done and what it would involve for you. Please read the following information carefully and take time to decide whether or not you consent to allowing me to observe a PBL session.

What is the purpose of the study?

The aim of the study is to help me to understand how a medical student goes about learning within a given PBL week.

Who is involved?

In order for me to obtain detailed information on how a student goes about studying within a given week I am inviting between 4 to 8 students to be researched as a case study. I would like to research students who have successfully already undergone three completed years studying within a PBL curriculum.

Why am I involved?

One of the students within your PBL group has volunteered to be a research participant. They are a participant for one week during a campus based week. Within this week I will aim to collect data relating to how they study, from a number of different sources, one source being that I would like to observe the student within their PBL group.

Will any data be collected on me?

All data collected will be referenced to the student who is a research participant. So for instance, I may make a note that the PBL tutor asked the student to clarify a point, or that one of the student's peers asked the research participant a question.

What will happen if I don't want to my PBL session observed?
Observation of the PBL session, by me, will only go ahead if all, within the session, agree to my presence. Your decision to participate or otherwise will not affect your learning experience and/or your assessment.

What will happen with the collected data?
All collected data will be made anonymous and stored securely. The data collected will only be used for this research study.

Who has reviewed the study?
The study has been approved by the EDU Research Ethics Committee.

What if there is a problem?
If you have a question about any aspect of this study you should contact me and I will do my best to answer it. My name is Maggie Bunting and my contact details are below. If you have any complaints about the research then you are encouraged to contact my Head of School (EDU). The contact details can be found below.

Chief investigator
Maggie Bunting RGN, RM, MClinEd, PGCHEP
Lecturer in Medical Education.
Norwich Medical School
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ

Direct Dial: 01603 597173
Email: M.Bunting1@uea.ac.uk

Supervisor
Professor Nigel Norris
Centre for Applied Research in Education
School of Education and Lifelong Learning
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ

Email: N.Norris@uea.ac.uk

Head of School for education and Lifelong Learning
Dr Nalini Boodhoo
School of Education and Lifelong Learning
University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
Email: N.Boodhoo@uea.ac.uk

Please keep this information sheet for your future reference.

Appendix 16. PBL Tutor and Peer consent form

Consent to Participate in Research

Study Title:	A Study Exploring Students' Constructs of Studying and Learning Medicine (within a PBL curriculum)
Researcher:	Maggie Bunting
Sponsor:	University of East Anglia

This is a consent form for PBL tutor or PBL peer participation. Please read the participant information sheet for the PBL tutor and research participant's peers which contains important information about this study and what to expect if you consent.

Your consent is voluntary.

Please consider the information carefully. Feel free to ask questions before making your decision whether or not to consent. If you consent, you will be asked to sign this form and will receive a copy of the form. If you choose to consent, you may ask me to leave your PBL session at any time without explanation.

Signing the consent form

I have read the participant information sheet for PBL tutor and peer and I am aware that I am being asked to consent to a research observer within my PBL session. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to consent to Maggie Bunting sitting in on a PBL session.

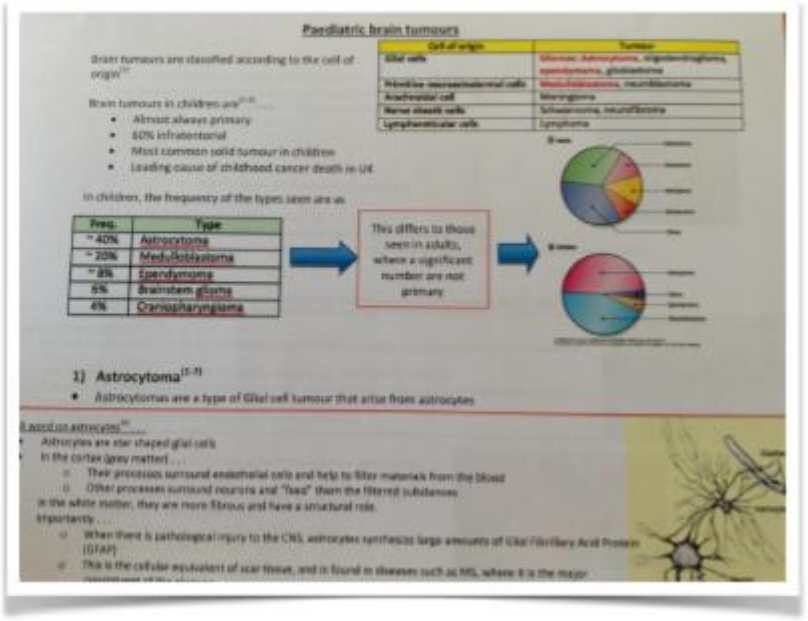
Signature of PBL tutor
Signature of PBL peer
Signature of PBL peer
Signature of PBL peer
Signature of PBL peer
Signature of PBL peer
Signature of PBL peer
Signature of PBL peer
Signature of PBL peer
Signature of PBL peer
Signature of PBL peer

Date and time

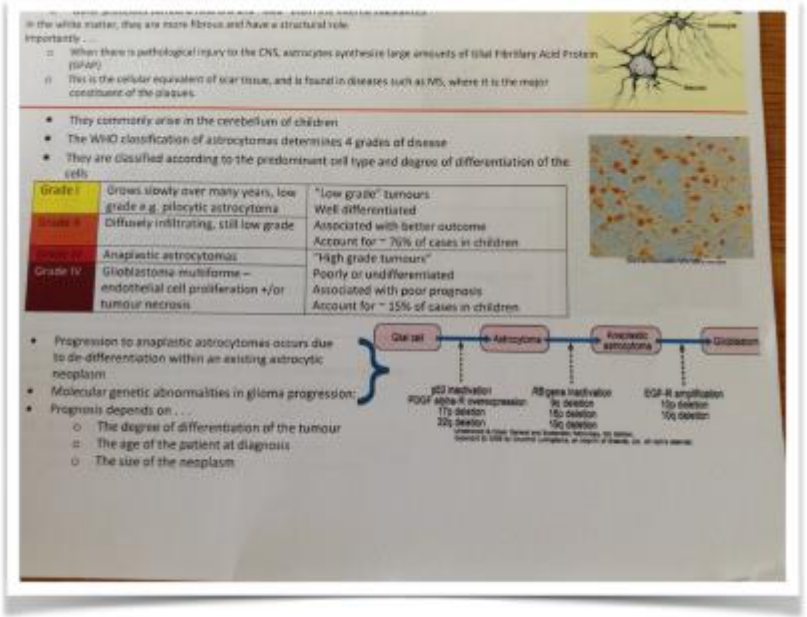
<u>Investigator</u>
I have explained the research to the tutor/peer before requesting the signature above.
A copy of this form has been given to the participant.
Maggie Bunting
Signature
Date and time

Appendix 17. Photo of Hazel's written product

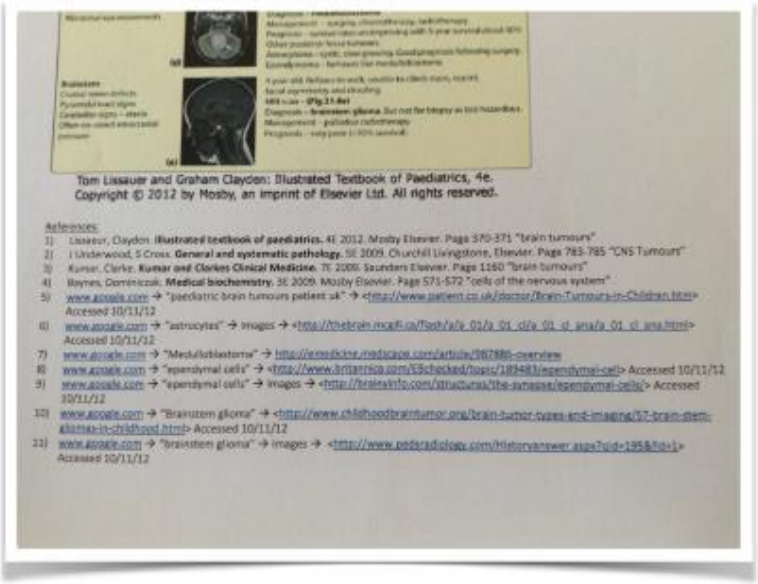
(WP4.1)



(WP4.2)



(WP4.3)



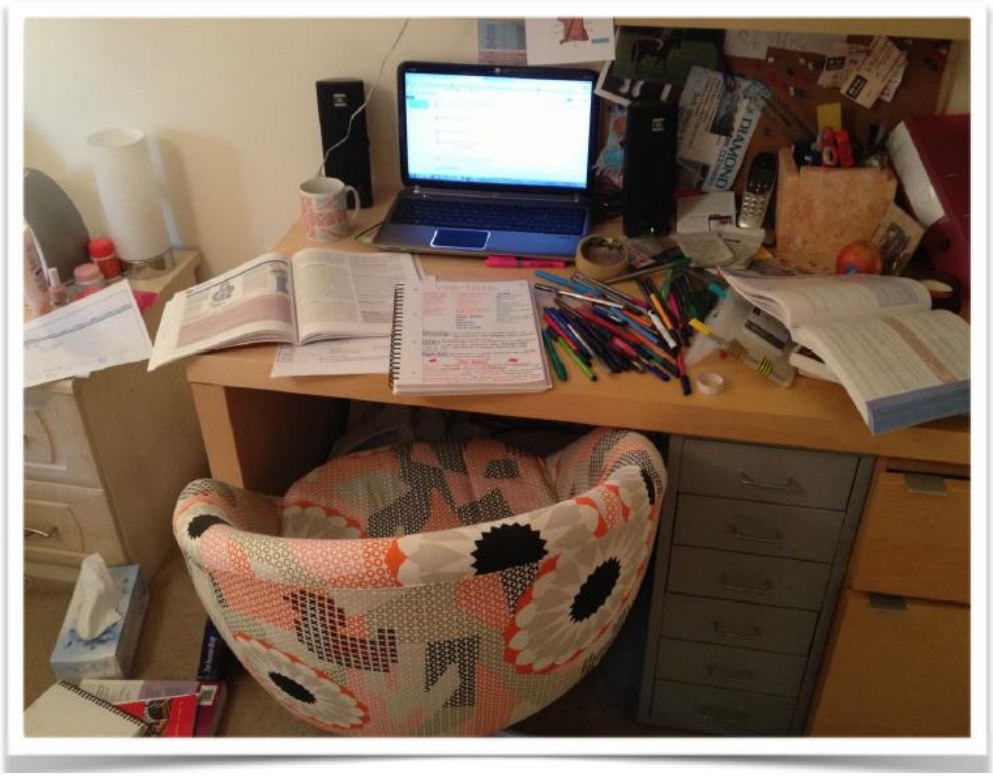
Tom Lissauer and Graham Clayden: Illustrated Textbook of Paediatrics, 4e.
Copyright © 2012 by Mosby, an imprint of Elsevier Ltd. All rights reserved.

References:
1) Lissauer, Clayden. **Illustrated textbook of paediatrics.** 4E 2012. Mosby Elsevier. Page 370-371 "brain tumours"
2) J Underwood, S Cross. **General and systematic pathology.** 5E 2009. Churchill Livingstone, Elsevier. Page 783-785 "CNS Tumours"
3) Kumar, Clarke. **Kumar and Clarkes Clinical Medicine.** 7E 2009. Saunders Elsevier. Page 1160 "brain tumours"
4) Baynes, Dominiczak. **Medical biochemistry.** 3E 2009. Mosby Elsevier. Page 571-572 "cells of the nervous system"
5) www.google.com → "paediatric brain tumours patient uk" → <http://www.patient.co.uk/doctor/Brain-Tumours-in-Children.htm> Accessed 10/11/12
6) www.google.com → "astrocytes" → images → <http://thebrain.mcgill.ca/flash/a/a_01/a_01_cl/a_01_cl_ana/a_01_cl_ana.html> Accessed 10/11/12
7) www.google.com → "Medulloblastoma" → http://emedicine.medscape.com/article/987886-overview
8) www.google.com → "ependymal cells" → <http://www.britannica.com/EBchecked/topic/189483/ependymal-cell> Accessed 10/11/12
9) www.google.com → "ependymal cells" → images → <http://brainyinfo.com/structures/the-synapse/ependymal-cells/> Accessed 10/11/12
10) www.google.com → "Brainstem glioma" → <http://www.childhoodbraintumor.org/brain-tumor-types-and-imaging/57-brain-stem-gliomas-in-childhood.html> Accessed 10/11/12
11) www.google.com → "brainstem glioma" → images → <http://www.pedsradiology.com/Historyanswer.aspx?qid=195&fid=1> Accessed 10/11/12

Appendix 18. Photo of Jennifer's notebook

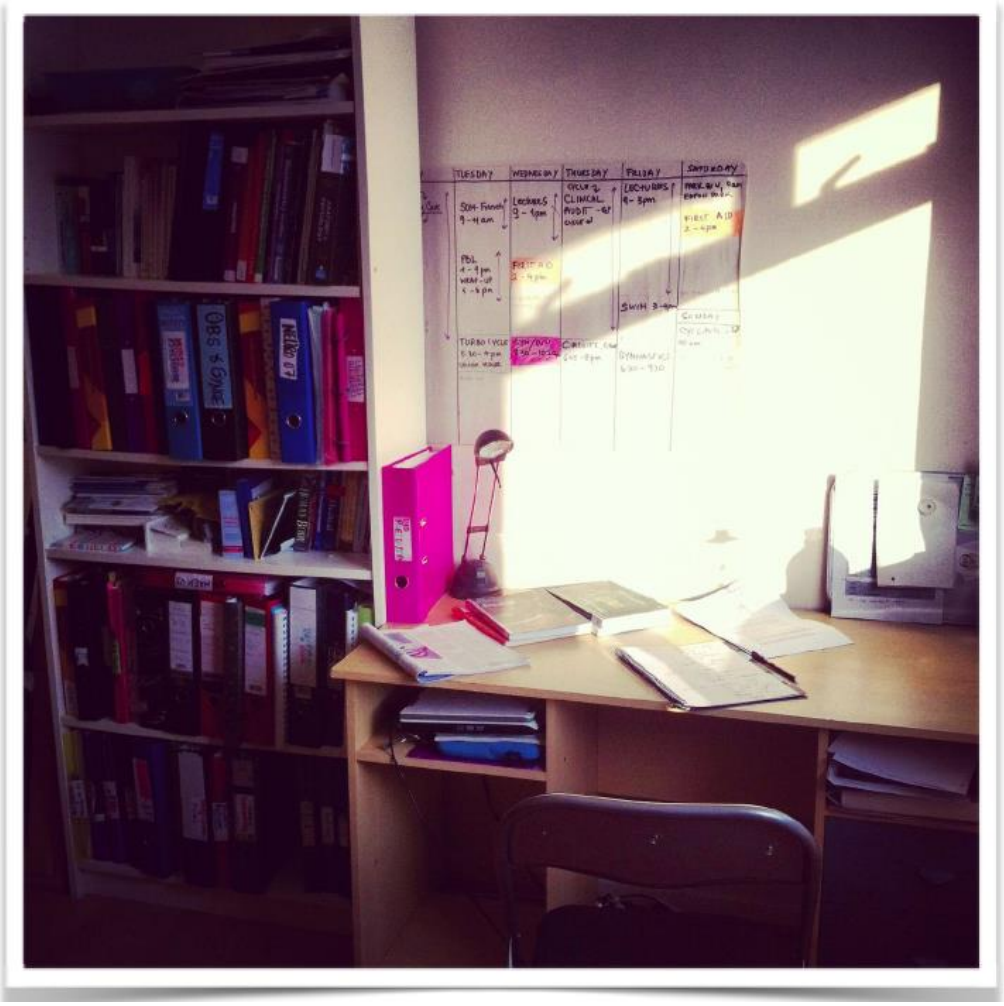
Jennifer's notebook with her global learning outcomes despite having access to the faculty learning outcomes. (P2.420)

Appendix 19. Photo of Jennifer's Study



This image, photographed by Jennifer, is taken as she is making notes from her text book (P2.419)

Appendix 20. Photo of Anika's study area and Rebecca's study area



Anika's study area (P5.424)

Rebecca’s study area (P1.416)